BULLETIN OF THE

TAYLOR SOCIETY

AN INTERNATIONAL SOCIETY TO PROMOTE THE SCIENCE
AND THE ART OF ADMINISTRATION AND OF MANAGEMENT

IN THIS NUMBER

Papers on Functionalization, Equipment and Materials Control, Methods of Wage Payment, Personality Influences in Selection and Placement, Job Analysis as a Basis for Teaching and another chapter from "Scientific Management in American Industry"

Engineering Societies Building
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The objects of this Society are, through research, discussion, publication and other appropriate means:

1. To secure—for the common benefit of the community, the worker, the manager and the employer—understanding and intelligent direction of the principles of administration and management which govern organized effort for accomplishing industrial and other social purposes.

2. To secure the gradual elimination of unnecessary effort and of unduly burdensome toil in the accomplishment of the work of the world.

3. To promote the scientific study and teaching of the principles governing organized effort, and of the mechanisms of their adaptations and application under varying and changing conditions.

4. To promote general recognition of the fact that the evaluation and application of these principles and mechanisms are the mutual concern of the community, the worker, the manager and the employer.

5. To inspire in labor, manager and employer a constant adherence to the highest ethical conception of their individual and collective responsibility.

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Comment

AFTER the manner of the schoolmaster we give our members their text-book assignments for preparation for the December meeting. No. 1, for reading during the summer, is the recently published *"Report of the (Hoover) Committee on Recent Economic Changes."*[1] No. 2, for reading in the fall, is the forthcoming Taylor Society book, *"Scientific Management in American Industry."*[2] These assignments indicate the theme of the December meeting; it may be stated as follows:

Recent Economic Changes and Management
The Outstanding Problems of Today
The Emerging Problems of Tomorrow
The New Demands Upon Management

THE report of the Hoover Committee is a formidable-appearing two volumes, but we have discovered a formula which simplifies the labor of the reading. First, read the report of the Committee—the first seventeen pages. Second, read the "Introduction" to the main body of the report, by Edwin F. Gay—twelve pages. Third, read the "Summary" at the conclusion of each of the fifteen fact-reporting chapters or sections of chapters—some forty pages. Fourth, read the last chapter, "A Review," by Wesley C. Mitchell—seventy pages. Finally, turn back and browse through the fact-reporting chapters leisurely and in any order that one pleases, according to one's interests and the numerous questions which have arisen in one's mind.

FOR many questions will have arisen in the reader's mind. This report is a quantitative and not a qualitative analysis. The questions it answers are of the what and how-much class; the questions it does not answer, but stimulates, are of the how, why and what-the-consequence class. It is to the latter class of questions that attention should now be directed, a factual basis for study having been provided by the report. To industrial executives who look ahead the general question is, what effect are these changes having, and what further effect will they have, on the status of particular industries in industry generally, and on purposes, policies, plans and methods of management?

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[1] McGraw-Hill Book Company, New York.

[2] Harper & Brothers, New York. Announced on the back cover of this issue.

The Pros and Cons of Functionalization

Its Ability to Further Man's Culture and Development as Part of Industrial Culture and Development the Criterion of Its Usefulness

By JOHN LEE, C.B.E.[1]

IT IS comforting to reflect that one of the vastest pieces of industrial organization in the history of the world was associated with the beginnings of an undying literature. The building of Solomon's temple called for a closeness of organization which amazes one the more it is examined. Solomon himself was the chief organizer, with a passion for detail. His association with Hiram of Tyre for the production of all sorts of material, gold and silver and cedar and purple, and for the purchase of the services of skilled workmen, including Huram-abi, the architect, was the beginning of a functional division, for there were the skilled technicians and side by side with them there were the workers—over 70,000 of the "strangers in the land" to bear burdens and 80,000 to hew the stone in the mountains and 3,600 overseers, probably Israelites, as deserving a more honorable position. One would like to know more about this early venture in industrial organization, and by what means some of the tremendous stones were carved and conveyed, and how the great brass laver resting on twelve oxen, with the bases on which they were wheeled from place to place, was brought to Jerusalem. Still the broad divisions show us the separation between artistic designing, artistic production, the labor of transport and the labor of building with their parallel distinctions in supervision.

Functional divisions, at least in their essential form, have a long history. There is an admirable account in Mr. H. Stuart Jones' article on "Administration" in "The Legacy of Rome" of the organization which "without ceasing to be the imperial household, became the Whitehall of Ancient Rome." There is the accountant, the principal private secretary, the clerk of petitions, with five differentiations of function, and later on we find Hadrian breaking with "the idea that the citizen must be equally qualified to render service in peace and war" and establishing a purely civil service with functional divisions. So, also, we find functional divisions in the ecclesiastical orders and throughout history we see recognitions of the fact that organization always demands some functional differentiation.

As functional divisions are urged upon us today they come from that conception of scientific management which believed that organization should be focused upon functional divisions. So it was that in Taylor's scheme there were to be eight foremen each with his own function. This extreme doctrine has largely been surrendered and functional division takes a part which I think can best be called a co-ordinated part in organization. What exactly that co-ordinated part is to be has not been thought out. It seems to me to be quite fair to say that functional division of higher responsibilities has its kinship with that functional division of the work of production which we call "mass production." It comes from an emphasis upon men in the bulk rather than upon men as individuals. In a sense it is a recognition of human limitation, but I would prefer to describe it as a correlation of human capacities into an organic whole. I take the following definition from a recent valuable book on factory organization,[3] "By this plan specific functions common to all or several departments. . . are each placed in the hands of a man specifically qualified for his particular function, and instead of giving attention to all the factors in *one* department, he gives his attention to *one* factor in all departments." It means, obviously, that what ordinarily we have called "departments" are broken up and there are fresh divisions on a functional basis culminating in the management. From the same admirable book we may sum up the advantages and the disadvantages of functionalization before we come to our own analysis. There is no doubt a focusing of an expert efficiency which tends to raise the whole tone from the point of view of considered expertness. There is a basis for expansion which is not provided by the departmental system without vast change and the addition of departments. There is the presumption that men are better suited to the function to which they are allotted and that they will be for that reason more happy and confident in their work. Then there is the fact that it is a type of specialization which is in accord with the spirit of the age. So far for advantages. On the other hand a precise delimitation of function is exceedingly difficult to fit in with an organization and it does happen that a functional organization is very complex. It demands a sense of organization which conflicts with many natural human instincts and especially with the instinct of control, for to fit in a functional organization demands self-surrender. There is also a danger lest responsibility should be passed from function to function since it is exceedingly difficult to divide and to define the functions. Lastly there is the fear lest the functional division should not fit in with human qualities so that capacities and inclinations may either overlap or find themselves lost between functions.

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[1] Mr. Lee was personally known to Professor Joseph H. Willits of the Wharton School of Finance and Commerce of the University of Pennsylvania, who pays him the following tribute:

"In ten months in Europe I met no person whose philosophy of management was more interesting or seemed to me to be contributing so fundamentally to the profession of management as that of Mr. John Lee. For forty-five years he had been in the British Civil Service—the later years being spent as Comptroller of the Central Telegraph Office. He was the British delegate to the International Telegraph Conference held in Paris in 1925 and was Chairman of the Conference during the months over which the meetings were spread. After resigning his position about two years ago, owing to failing health, he continued his many connections with management and with management teaching. He published many significant articles and was the author of a number of books, including the following:

Letters to an Absentee Director
Management
Industrial Organization
Dictionary of Industrial Administration (Editor)

He had to an unusual degree the faculty, not always given to men in management work, to think in terms of the philosophy behind the concrete symbols and devices to which the most of mankind predominately give their attention. The world lost a delightfully engaging personality, and management lost one of its most fundamental assayers when Mr. Lee died on Christmas Eve on board the "Laconia" while returning from a visit to the United States. This article delivered at one of the conferences at Oxford University therefore constitutes one of his last messages to 'management science.'"

When we come to examine the position in our own way it is as well to remember that functional divisions of authority and of responsibility differ in degree rather than in kind. Put as we have put it above there would seem to be a fundamental difference between the departmental and the functional system, the former being sometimes called "geographical" or "territorial." It is very doubtful if there is today a purely "geographical" system of division in any industry. At any rate the accounting will be separate and will function for all the departments; so will the technical processes and at the other end the sales. Then it should be remembered that in life there is a considerable adoption of the functional system. The professions are functional and indeed as time goes on the functional side is emphasized, as can be seen in the medical profession where it is now customary for two or three medical men to be associated together in serving a district, a remarkable change from the "geographical" or "territorial" to the "functional," and very considerably aided by the telephone and the motor car. We may say therefore that in industry we are faced not so much by the crude issue between the functional and the territorial systems as by the more or less of the functional. Moreover, it will be as well for us to have in mind the danger which accrues from striving to build up a final organization at one stroke. "We shall be fortunate," says Mr. Stuart Jones, "if the builders of the new order bring to it the tact and patience of Augustus and his infinite capacity for taking pains in framing provisional institutions so as to provide for orderly development." When we place a perfected departmental system side by side for purposes of comparison with a perfected functional system we are failing to recognize the fact that growth and development are of the essence of any human organization. The error which Taylor made in his eight functional foremen was to overlook the human need on the part of the workers for such definite direction as is incarnated in one person. It is true that to have a foreman who in turn appeals to eight functional chiefs is to make it but one remove; it is, however, just that one remove which makes all the difference. It is the intrusion of some of the departmental element which makes the functional organization possible.

On this ground, therefore, I would hesitate to put into crude and rival divisions the pros and the cons of the functional system. It will be wiser, I think, to take it for granted that the functional system is inevitable, just as mass and machine production was inevitable. But it is the work of human beings to safeguard humanity against many ills which seem to accompany movements apparently inevitable. A full-fledged functional system, vigorously introduced, is full of peril. In the first place it tends to dethrone the discipline of industry upon the human mind. It operates in this direction by its tendency to rob the industrial worker and his immediate director of the sense of a completed product resulting from their work. Put a little differently, it has in respect of direction precisely the demerit of mass production. In the second place, though it would seem, on the face of it, to allot responsibilities according to particular capacities, it does leave gaps, and the more precise the functional division the more likelihood there is of these gaps and of friction in respect of operations where it is doubtful whether they belong to this or to that function or, on the contrary, belong in a measure to more functions than one. This possibility of friction does much to counterbalance the increase of skill and of zeal and of happiness which follow from the allotment of responsibilities according to personal qualifications. In the third place, there is a lack of elasticity. It follows in many cases that an increase of knowledge on the part of a functional director tends to bring him up against the hard walls which limit his function. Lastly there can be little doubt that to the really able functional director a long experience tends to irritation and to discontent, and discontent on the plane of leadership is a very grave evil. It is not always the case that the function fills all that he finds himself able to do. He peers over the walls, as into a paradise, and he regards his reputation in one particular line as being almost a disaster to him. If only, he sighs, he could change his function for a while—but then it is of the very essence of the functional system that the functions are permanent or, at any rate, that they are not readily changeable.

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[3] Northcott, Clarence H., and others, *"Factory Organization,"* London, Sir Isaac Pitman & Sons, Ltd., 1928.

So that where we stand in constructive criticism of the functional system is to seek such an application of the system as will be least disadvantageous to human kind. Manifestly the continuous intensive development of industry and increasing competition force upon us the adoption of every means to efficiency, and among those means the functional system of direction is inevitable. Where this system has been introduced to the best purpose the greatest care has been taken to procure coordination, sometimes by committees and sometimes by a special co-ordinating functional director. In its origin, however, as laid down by F. W. Taylor, it was a much simpler matter than it has become, for it was "a recognition of qualitative differences, as to capacities required and the conditions of routine performance, between the function of execution in manipulating machine or tool and the function of planning and preparing work; and the grouping of operatives into two major divisions responsible respectively for these qualitatively different groups of functions." Thus the present claims for somewhat elaborate differentiation of function have grown from the original differentiation into two functions, on which all would probably be in agreement, and where coordination was not so difficult. It is co-ordination which is the crux of the problem today. We may smile at the suggestion that a specially expert staff has been necessary in some cases to co-ordinate the precedent work of experts. It is clear, however, that functional development is only practicable, or at any rate is more likely to be successful, where it is firmly based upon a departmental division with co-ordination secured to begin with. On this subject of organization we have much to learn, in general, from the Army, but in no particular is the lesson more valuable than in the means of weaving a functional system into a departmental system. Signals, communications, ordnance, aeroplanes, tanks—all of them highly technical modes of warfare—have successfully been brought into play, and they have their proper subordination to the general scheme while they have their full functional development. We may apply in a spirit of paradox this lesson to industry by saying that we shall get the best results from an adoption of the functional method where we do not attempt to substitute it at once and *in toto* for the departmental or geographical or territorial method. Probably much of the criticism which the functional principle has received has been due to this preliminary misunderstanding. It has been regarded as an alternative method of organization from top to bottom and men trained by long years of experience and of habit to the other systems have found it difficult to adapt themselves to it. We should have made more progress if we had proceeded a little more slowly. We had forgotten that for the most part the organization under the old conditions was largely haphazard and that we needed to teach the value of organization itself before introducing a principle which depends upon the sense of organization. The balance between functional direction and general direction has to be found in the particular industry and it has to be found at various levels. It is in the effort to discover this balance that we shall learn to develop the sense of organization and to find the true place for a functional system.

Then there is the question of the individual. Men and women who are conscious of their ability, who have the sense of responsible leadership, are bound to feel that the functional system robs them of scope. They have been accustomed to looking at the industry as a whole, at its processes as a whole, at its production as a whole. They find themselves not only focused in their attention but actually robbed of other points of view. They feel that though all along they may have had a specialized functional interest, yet that it was accompanied by healthy marginal interests, and that these are ruthlessly cut off. Instinctively they regard themselves as sacrificed, under a functional system, to the success of that system. To these criticisms, weighty as they are, we have to make the reply that the functional system has some place in the adaptability of industry to be the chief force which is fashioning us in our time. Whether it be a tradition from the individualism of last century or not the fact is that our lack of social cohesion today is largely due to the fact that in our industrial enterprises we are not yet being trained in social cohesion. It may be that the functional organization in future will play its part in welding us together more closely and more mutually. Plato told us, as St. Paul told us, that there are diversities of natures amongst us which are adapted to different occupations, that all things are produced more plentifully and easily and of a better quality when one man does one thing which is natural to him and done at the right time, and when he leaves other things. Possibly that referred rather to professionalism of calling than to functionalization as we understand it in the unit industry. Yet there is reason to suggest that just as this moderate functionalism was the basis of Plato's claim for a co-ordinated state so the interweaving of functions and the close interdependence of human unit with human unit may come about from an acceptance of the functional system in industry in such a way that it may develop, but also that it may be co-ordinated. To the Greek mind the city or state, convertible terms, was a community—an association of men—an ethical unity. It was this concept which dominated the social theory of Plato and Aristotle. Civic life was the normal life, and it was the relations which men sustained to each other and to the collective whole that constituted the problems of social philosophy.

They constitute also the fundamental problem of industrial administration. I have described functional organization as inevitable. I believe that it is inevitable if there is to be organized efficient production. But there is reason, at the same time, to be apprehensive if it is introduced as a completed whole without regard to its corollaries. So essential is co-ordination that I would plead for the continuance of the departmental organization as the basis and the introduction of the functional system gradually and only so far as the "sense of organization," to use words which Dr. Northcott uses in the book I have already quoted, justifies the venture. Nor is it certain that there are types of mind which suit the functional and others which suit the departmental. It may indeed prove to be wise, when we know something more about functional systems in practice, so to organize the functional tasks that men may pass from them to departmental tasks, or may pass from one functional task to another after a reasonable, probably rather a long, period. There may be an apparent loss at the time but the widening of outlook and the freshening of outlook may prove to be an ample recompense. For it is not only that we are considering the influence of our method of industrial organizations upon the men and women to whom we give the exercise of authority but that we are remembering that this, in turn, will react and that the industry of tomorrow will gain. The precision of the detail which will be within the scope of the knowledge of the functional practitioner will be all the healthier when it is balanced by being transferred to the point of view of general management or when, perhaps, it is correlated to the detail of the knowledge of another functional position. We have leaped rather too readily to the view that the functional positions are finally and permanently separated from each other and from the management. We have leaped far too hurriedly to the conclusion that the functional divisions, as we have made them to suit our industry, correspond to some basic psychological differences. It may be that the differences are not basic and that a higher culture for industry is practicable by means of a functional system which has been weaved into a departmental organization. It may be that by some such means as these we can aid in the necessary task of coordination, and that we can use men far more highly trained, with experience in a few functional responsibilities, in the work of general direction to the advantage of that direction.

Thus I am not at all ready to take up the cudgels either for or against the functional system. In the rush of enthusiasm in which it was introduced there were very real dangers and these dangers were so evident that many were led rather hastily to scrap functionalization altogether. But it is clear that in some way or other we must provide for a close specialization and that where the same type of specialization is needed in various departments of an industry a functional allotment is inevitable. Not only is it specialization but it is particularization of a point of view. Wise management can see this coming and set out to meet it without making a sudden change from departmental or territorial organization to purely functional organization. To go out and meet it is one thing, to provide for it, to test it within the range of its adoption so that its value for a wider range will be known—this seems to indicate the sound process. But it will depend upon the industry and it will depend upon the management. For we shall do well to ask ourselves how it comes about in our industries, with all the opportunities which we have had for closer organization, that in the main we have failed to procure any similitude of social cohesion. For this purpose there can be little doubt that functional organization is an effective means, since it demands personal skill and the frank recognition of the skill of others. In this way industry may yet take its place in the training of mankind.

Though I claim that functional direction is inevitable, just as more and more finely distributed mass production is inevitable, I do not think that standing alone they will be tolerable as the method of industry. The instinct of man will seek something which makes a wider demand upon his capacities. So if we are convinced that functional direction and machine-mass-production are essential to the successful conduct of industry and to the supply of an ever increasing demand we shall be bound to accompany both the direction and the work of production with other methods into which mankind can throw capacities and energies of a different kind. It is at this point that we can reach a summary judgment. Functionalization is an essential instrument in the conduct of industry, an essential element in the organization. But it is an instrument in the hands of man, an essential element in the organization which is to be subordinate to man. By what means mankind will be able to use functional direction in industry and yet keep himself free from its evils, if it should obtain the dominance, is not easy to say at this juncture. We have not yet gone far enough from the departmental or the territorial method to be able to conjecture what would be needed if functional organization became dominant; precisely in the same way that we have not yet gone far enough in respect of mass or machine production to be able to estimate its appropriate limits. Neverthless we are able to peer into the future and we can make something of a guess as to the direction in which correctives for functional organization as for mass production will be found. Clearly they will be in the nature of corporate efforts at an understanding of the full purpose of the industry; clearly, too, they will use some machinery of the corporate type for the focusing of a common attention upon the central purpose, accompanying it by manifold contributions from experience and knowledge. If it means therefore that functional organization makes this demand upon us, if it quickens our interest and warms our human associations, it may be that it will achieve far more than its votaries dared dream. It may lead the way to cheaper and better organized production and thus to further triumphs of industry, but at the same time it may be the means of a revolt against the very narrowness of life, both of direction and of production, for which it may seem to have been responsible. Those who introduce functional direction with some such vision in their minds may be building far more securely than they know, and the structure after it is reared may be a true and real association not merely in production but in that mutuality of endeavor which brings the best out of men and by that means builds for the generations which are to come.

We know something of the legacy of Greece and of Rome and of the Middle Ages. It is clear that the legacy which we shall leave behind us is the legacy of industrial organization, far more inclusive in its scope than we yet realize. If we are to hand it on with due and appropriate and balanced and sensitive regard for the men and women who are to use it as a mighty instrument, we shall need to consider in what way it shall be constructed as not only to permit and to encourage each individual to do his best but to permit and encourage the corporate whole to be more effective by reason of the greater efficiency of the individual as individual and as part of the corporate whole. This is the task before us and we must watch all our experiments from this angle. It subtends more of human life than we suppose. It means that man is learning from industry in what manner he shall live and that involves a recognition both of the corporate and of the individual aspects and of a *tertium quid,* the sacredness of the individual aspect as part of the corporate aspect.

A very effective parallel may be drawn between colonization and industry to illustrate this point. The task of British colonization today is infinitely more difficult and infinitely more complex than the colonization of ancient Rome. It is not because the distances which separate the mother country from the colonies are immeasurably greater, but because the establishment of Britains overseas must involve a nationhood of their own which yet shares in the nationhood of the home country and of the whole. Rome colonized the world and held her colonies in a firm grip. Today there must be something more than a strong grip from the center; there must be a radiant life pulsing through the whole. In industry the old departmental divisions will have many of the characteristics of the Roman colonies and in so far as we use the functional system wisely it will be to seek the channels for a flow of life both outward and inward of which the purely departmental system did not prove itself capable. Yet in doing so we must remember that the functional system itself is an instrument only and that it is not life but only a channel of life. This sums up the position which we shall claim for it. As yet no one can define the limits but we can define the purpose. It may aid us to a far closer welding of the industrial structure enabling all men's contributions more readily to be offered and more readily to be accepted. With this as our criterion we may well proceed knowing that, as yet, we are in a very rudimentary stage in respect to knowing and understanding of what it is capable. But with an appropriate sense of balance, with a recognition of the sense of organization in which it can take its place, we can boldly adopt this and that experiment, provided that the sacredness of man is kept steadily before us and that his culture and his development are definitely regarded as part of industrial culture and industrial development. Where functionalization unites the two it is a helpful ally; where it separates it is an evil.

THIRDLY, and most important of all, I believe that the functional conception of management, alone of all the theories of industrial organization which have been put before us in the last decades, really goes to the heart of our difficulties. In his last book, Mr. H. G. Wells writes, "A vast amount of moral force has been wasted in the past hundred years by the antagonism of Labor to Capital, as though this was the primary issue in human affairs. But this never was the primary issue and it is steadily receding from its former importance." I believe that to be absolutely and literally true. No man, whatever his political complexion, who has any practical experience of administration today, really pretends to himself that a mere shift of ownership in the means of production, or in the right to its surplus, will make any fundamental difference in industrial relations. Whatever the ownership of industry, the real hardships will continue unless there is a fundamental change in organization and method. ("The Nature of the Educational Training to Equip Foremen and Supervisors," by L. Urwick, O.B.E., M.A., from Report of First Triennial Congress of the International Industrial Relations Association held at Cambridge, England, July, 1928, on the subject of *Fundamental Relationships Between All Sections of the Industrial Community, pp.* 144-145.)

Production Management[1]

A Treatment of Two of Its Major Phases—Equipment and Materials Control

By HOWELL K. HALLETT

Southern General Manager, The Kendall Company, Paw Creek, N. C.

THE material of this paper is drawn largely from the cotton manufacturing end of the textile industry where matters of equipment and materials control make up the main manufacturing problems of the industry. The other problems of production management are provided for to a large extent in the nature of the processes involved in cotton manufacture. Predetermined standards of production and cost are not possible of fulfilment, however, without a high degree of machine efficiency and an effective system of handling materials and supply parts.

Equipment Control

Equipment control, or plant maintenance, can be divided into five main subdivisions.

1. Machinery
2. Belting
3. Electrical equipment
4. Buildings (village)
5. Fire protection

1. *Machinery Inspection and Maintenance.* The purpose of this is to prevent, as far as is possible, interruptions in operation and loss of production due to machinery and equipment in bad order or broken down. To accomplish this purpose it is necessary to (1) inspect machinery and equipment at such intervals as to insure the detection of wrong adjustments, wear or impending breakdown; (2) make such repairs or replacements as inspection shows to be necessary; (3) keep systematic records of equipment inspection and repair, and (4) keep tickler records to warn of the necessity of reinspection.

One of the most important points to consider is the qualifications of the inspector or inspectors. It is essential that the inspector have experience which would enable him to qualify as a first class machinist, with some knowledge of motors and electrical starting equipment. His schedule of inspection takes him into all departments of the mill and brings him into contact with overseers, second hands, section hands, loom fixers, etc. For this reason he must be in a position to command respect because of his ability. He should also have the faculty of being able to win the co-operation of his fellow workers.

Inspection is carried on by the regular inspector and is confined entirely to machine maintenance. It does not cover inspection of operating conditions and machine settings, such as that carried on by order of the department overseer. For example, it is not the purpose of maintenance inspection to check up on card or loom settings, but a check on the wear of gears and bearings is well within the limits of this inspection. In other words, it is a machine inspection and not an operating inspection.

Reports on boilers, steam engines, pumps, motors, mill roof, windows, heating system, shafting, hangers, counter pulleys, elevators, sprinkler pipes, etc., take care of scheduled inspections on other than actual process machinery.

The schedule of inspection is provided for by a series of forms on which the items which are to be inspected in connection with every machine are listed. To simplify the reports the questions are so worded that, in a majority of cases, the inspector has only to check "Yes" or "No" in a column in order to indicate the condition of the machine items. If further inspection is required than the check in the "Yes" or "No" column indicates, a check is put opposite the proper item in a "Remarks" column. Here also the inspector lists any unlisted defect or alteration that needs attention.

A few of the questions pertaining to resistance motors are given in illustration.

	Yes	No	Remarks
Motor tight on base			
Brushes tight			
Brushes burned			
Resistance spools burned			
Sleeve worn			
Dust guard tight			

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[1] A paper prepared for the Spring Meeting of the Taylor Society which was to have been held in Charlotte, N. C., on May 1 and 2, 1929.

Brush shafting lever worn
Cable connections to resistance spools tight
Terminals tight
Toggle for brush shafting lever worn
Rollers for shafting lever worn

The arrangement of the inspection forms in the tickler file requires very careful consideration, because it brings up the question of the frequency of inspections and the element of time involved in the inspection itself. Some items, such as looms, may require three or four days for inspection; other machinery of necessity has to be inspected during week-ends. Some equipment should be inspected weekly; whereas every six months is often enough for other items.

After the time element is determined, a tickler file consisting of sections for the twelve months, with daily tabs for the active month, is arranged. At the beginning of the year, the days of each month are listed and the form number for each report is listed opposite the predetermined date. At the end of the month someone in the office takes the list for the next month and places the proper form numbers behind each date in the tickler file. The first thing every morning the inspector goes to the plant maintenance tickler file and takes out the inspection forms for that day only. The following morning, he gives one copy of the previous day's report to the overseer in whose room the inspection was made, and the other to the office. The inspector's duties cease when the reports with their findings are turned in to the office. The office copies of reports are held until the overseer turns in his copy with the notation that the work recommended by the inspection is completed. The two copies are then filed together. It should be the duty of the manager or his assistant to check up occasionally on items reported by the overseer as "corrected."

There will be times when, in the opinion of the overseer and the mill manager, it is not desirable or economical to carry out the inspector's recommendations. When this occurs, the reason for such a decision is stated on the file copy. It should be noted that failure of the overseer to agree to a given recommendation by the inspector does not necessarily constitute a criticism of either the overseer or the inspector. The inspector's duty clearly is to report conditions as he finds them; whether his judgments are followed must be left to his superior's discretion.

Obviously there are some machine parts which require internal inspection and which the inspector has no time to take apart himself. It might be helpful to mention a few examples.

A mill, for example, has five pickers. One of these is taken down and thoroughly cleaned every week. Consequently, the inspector is able to make his internal inspection for wear on each picker every fifth week. The inspection of valves on steam pumps, triplex pumps and air compressors obviously cannot be made unless the machines are taken apart. If it is decided that these shall be overhauled every three months, the plant maintenance man makes his report at these periods. The forms for these machines which are carried in the tickler file and come up regularly every three months act also as a reminder to the master mechanic that it is time to do such overhauling.

2. *Belt Inspection and Maintenance*. The purposes of a system of belt inspection are, briefly: to keep the cost of belting at the lowest possible point by proper cleaning, dressing and inspection; to maintain machinery in operation at all times; to maintain the speeds of all machines at the standard set for each machine; and to maintain an adequate set of records, so that an accurate check may be had on the wearing qualities or the economy of any particular belt.

The duties of the belt man are to care for all belts in the mill, including motor, counter, to machine and purely machine belts, with the exception of cone belts on roving frames. In order to do this, he has a regular schedule for cleaning, dressing and inspecting. In general, all belts should be cleaned once a month. This, however, is not a fixed interval but is decided on the basis of local conditions. For instance, the speed records, of which more will be said later, showed us the necessity of cleaning card belts daily. Once a month, after cleaning a belt, dressing is applied if the belt man finds it necessary. Castor oil, neats foot oil, cod oil, tallow or a belt preservative recommended by the belt manufacturer, are all permissible. Nothing containing rosin or mineral oil is used because both are detrimental to belts. All belts are inspected on schedule for slackness or slippage. The belt man then determines the proper method of fixing them. He may decide to cut, clean, dress or repair the belt. Counter and motor belts are inspected while the machines are stopped each week. All split laps and other necessary repairs are made at that time.

The belt man must bear constantly in mind that a large part of his responsibility is to keep the wheels of the machinery turning at all times. Therefore, preparedness must be his motto. Whenever he leaves the belt shop, he should leave a card in his window stating where he may be found. He should also have a portable repair kit which contains all the tools necessary to do whatever work on a belt may be required, and pieces of belt or extra belt for making repairs or replacements on short notice.

All belting which is discarded by the operating department should be sent to the belt shop to be examined by the belt man. He may be able to rework part of it by cleaning, cutting or cementing so that, with other short lengths cemented from time to time, the belting can be replaced on the type of machine from which it was taken. Or, he may decide to cut down the width of the belt because of a ruffled edge. Out of small pieces, he perhaps can make bumpers and power straps for looms.

The belt man is required to keep some records and make a few simple reports. A tickler card is made out for each working day. As the belt man puts on a new belt, he also notes on the tickler card the symbol or location of the belt and the nature of the work to be done on it. New belts are inspected for tension at intervals of twenty-four to forty-eight hours, one week, or two weeks. All motor and counter belts, certain representative machine belts and all special or test belts have a separate belt record card. The purpose of this record is to give a representative cross section of belt performance in the entire plant. For this purpose it is much better to keep a relatively small number of cards well than to have many of indifferent value. These cards show an accurate record of performance of certain types of belting under various types of load, humidity conditions, etc. Many belts on cards, roving frames, spinning frames and looms do not require individual belt record cards. In order to keep a record of the rate of replacement on these belts by classes a belt renewal record was designed. The purpose of the belting cost record is to provide information from which material can be gathered for a complete record on the cost of belt maintenance over an extended period of time. By including on this sheet the cost of material and the labor time of taking speeds, cleaning and greasing belts, etc., this can be made of great value in actually determining the value of a belt system.

We have found there is often a loss of 7 per cent in machine speeds due to belts, and hence a loss in production. Therefore, on scheduled time at least once a month the belt man takes the speeds of the major producing machines in the mill and compares them with standards. If he cannot bring the machine up to standard speed through the medium of the belt, he determines the reason, such as a change of twist gears, and notes it.

The dimensions of the equipment, as well as the tools, in the belt room have been carefully studied to produce efficient workmanship. The room contains a desk for the various records, a preparing table for skiving, etc., a cementing table, a belt press table and press, a receiving table, belt and tool racks and tools and supplies.

The system of belt maintenance was inaugurated at our Thrift Division. The man employed for this purpose was sent to a reputable belt manufacturing plant for a sufficient length of time to allow him to acquire information on standard methods of treating belting, working up pieces into long lengths, etc. Consequently, as belt systems were started at the other divisions, they sent their men to Thrift for two weeks, or as long as was necessary, to absorb the proper methods of working up belting and to install in their mills the Kendall Company belt system.

Belt charts, showing the location of all belts in the mill, pulley sizes and speeds, belt widths and thickness, shafting location and size, are a valuable adjunct to any belt maintenance program.

3. *Electrical Equipment.* All electrical equipment in the plant, starting at the transformers and carrying through the incoming lines, the switchboard, distributing line, fuses, disconnects, compensators or controllers, and the motors themselves should be subject to systematic and thoroughgoing inspection by the electrician at stated intervals.

In this paper only the motor inspection will be referred to. The motor record card was designed to record the essential data about each and every motor in the plant. The motors in the plant are numbered and the numbers entered on the motor card. Whenever a motor is repaired, the nature of the repair should be indicated in the "Remarks" column. In order to give a complete story in a minimum amount of space, the following symbols are used to indicate different classes of repairs: A—general overhauling, i.e., remove end shields, clean out bearings, clean and varnish windings, reassemble and paint motor; B—replace front bearing; C—replace rear bearing; D—repair rotor.

Whenever motors have been overhauled or inspected, the condition of the insulation is recorded. The condition is found, first, by observation of the windings and a note made as to whether there is any sign of abrasion, cracking, oiliness, etc., and second, by the use of an electrical instrument known as a "meg." The meg is an exceptionally valuable instrument for preventing unexpected motor failure, because it is designed to give an indication of the condition of the insulation in a motor by measuring the electrical resistance of the insulation in ohms. The indicating scale on the meg starts at zero. The first indication is 10,000 ohms; the second 50,000 ohms, and so on up to 800,000 ohms. The next indication is one megohm, equal to one million ohms. The scale then continues in megohms up to one hundred megohms and the final mark of infinity corresponding to perfect insulation. The insulation of a good motor ought to be over five megohms. Any motor which shows a test of over five megohms may be considered in excellent condition and almost certainly will run without further attention for six months or a year, always providing there are no accidents. A motor wherein the motor insulation test is one megohm is in doubtful condition. It must be remembered that this is still a very high insulation and the motor may go for months, even years, without breaking down. Such a test, however, does indicate that deterioration has taken place and is a danger sign indicating that the motor should be watched closely and the insulation tested frequently, probably three or four times a year. If each successive test shows a lower value than that of the preceding test, it is a positive indication that the insulation is deteriorating, and that within a relatively short time the motor will fail. It is, therefore, wise to remove such a motor from service at once. If a motor, on first test, indicates a resistance of 100,000 ohms or less, it should be removed from service at once and rewound.

4. *Village Inspection.* For the comfort of the operatives, as well as in an attempt to avoid major expenditures on houses, streets, etc., we have a predetermined schedule of village inspection along the same general lines as in the mills. The inspection covers such items as locks, screens, window sash, porch steps and floor, sills, chimneys, plumbing, etc., in the houses, and drainage ditches, sidewalks, streets, catch basins, trees, etc., in the village.

5. *Fire Protection.* The purposes of recording a systematic inspection of all fire protective equipment are more or less obvious. However, the proper maintenance of fire equipment is most important. The master mechanic, or someone selected by him, and approved by the mill manager, makes the inspection weekly. A specially prepared form is used as an aid and to assure the manager that no items are overlooked. Nothing is taken for granted. Each fire pail is checked, as are all valves, dry pipe alarm, fire pumps, automatic sprinklers, fire doors, hydrant houses and other equipment, water pressure, and general items which impress the inspector as fire hazards.

Materials Control

This subject in a cotton mill consists principally of a stores system for handling repairs and supply parts. These articles, of course, are not resale materials, such as cartons, paper, labels, etc., on which control is essential to keep merchandise fresh, but the same methods are applicable.

The necessity of controlling stores inventory is obvious. It might be interesting to know that in a plant we recently acquired, the inventory was over one and a quarter million dollars. Through stores control it has already been reduced over $300,000, and later it is certain to be lowered by an additional $200,000. At another plant, the turnover was increased from three to six times a year, which released half of its capital. In our Southern mills, we are operating on a two to one ratio of consumption to inventory, or an inventory turnover twice a year. For comparative purposes, a similar summary of ratios of each department of each mill, together with the dollars and cents value of consumption and inventories, is sent to each manager quarterly.

1. *Purchasing.* Before going into the detailed mechanics of stores control, the importance of purchasing should be developed, especially in respect to prices and quality. Recently, when the price of rubber was fluctuating, one rubber company that followed the market very closely had only a thirty days' supply on hand when the price of rubber broke, whereas others with large inventories lost millions of dollars. On the other hand, here is a typical thought sent out by our purchasing department. A price war had been going on between the manufacturers of a certain article with the result that the cost was $1.75 each delivered. The purchasing department investigated several points and found that the price was to be increased to $2.95; that the approved budgets for the year called for a certain number of these articles at each mill; that the stores balance sheets, with consumption figures, warranted the purchasing of these amounts. The result was that we saved several hundred dollars on this one item.

To assist the purchasing department, we have two sources of information; one, a standards committee and the other a research department, both working hand in hand. These organizations make it possible for the purchasing department to obtain information for the mill managers as to the merits of any untried material upon which a report is requested. At the same time, it is to be remembered that no experimental materials are used without the approval of the chairman of the standards committee. Requisitions of this nature are passed along to him for approval by the purchasing agent. In addition to working up information on untried material, the purchasing department makes frequent reports on the length of service of, or savings in cost on, certain materials. These figures may cover several years' consumption and are based on such articles as cost of oil per spindle, shuttle per loom, check straps per loom, pickers per loom, roller covering per spindle, etc.

2. *Stores Control.* The chief function of the general stores room is to provide a stock of supplies and repair parts necessary to the operation of the mill. These items fall into two broad divisions, "classified stores," or those items regularly carried in stock, and "unclassified stores," or those items or pieces of equipment ordered for special purposes. The operation of the stores room involves two things: the physical handling and arrangement of materials, and the record keeping necessary to maintain and account for the physical stock. In general, the "stores clerk" is responsible for the physical stock and the "balance of stores clerk" for the bookkeeping involved in accounting for that stock.

The stores room is arranged with a series of bins, each containing one item of material, although there may be several of the same items in the same bins. The bins carry bin tags for identification and are so arranged as to allow ready reference to book records. The inventory of classified stores is carefully controlled with the aid of the balance of stores record. This record shows at all times the quantity and value of each item of stock and provides certain control information to aid in maintaining inventories at the proper point. When it is necessary to order material, a requisition is filled out and mailed to the purchasing department; a purchase order is then sent to the vendor and copies to the requisitioner. When goods are received, that fact is reported to the purchasing department on a "notification of material received" form and entries are made on the balance of stores sheets. Prices are obtained from the invoice. If material is returned to the vendor for credit a "memorandum of material returned for credit" form is used. When material is needed in the mill, an order known as an "issue" is presented to the stores clerk, who uses this as his authority for supplying the items called for. If material is to be returned to stores for credit, a similar form known as the "stores credit" is used. In either case, entries must be made on the balance of stores sheet, reflecting the change in the quantity of goods on hand. Once a week, sheets and credits are classified by mill departments and summaries known as the "weekly issue report" and "stores accounts receivable" are prepared.

The balance of stores record is provided to record all data necessary for the control and valuation of classified stores. A separate sheet is used for each item of stock, arranged alphabetically by symbols, about which more will be said later. The control entries on the upper part of this sheet include a description of the article, the purchase time, the record of consumption, and the minimum amounts and amounts to order.

A concise description of the article is necessary as a means of identification. Since this description is to be used in the requisition of material, it is desirable that the manufacturer's name for the article be used wherever possible.

A certain time elapses after receipt by the purchasing department of requisitions before the material can be delivered at the mill. This period is designated as the "purchase time." The purchasing department supplies this information, which is entered on the balance of stores sheet, for each item, along with the date on which the information was received.

In order to determine the point to which stocks may be allowed to drop before reordering, an accurate knowledge of the rate of consumption is necessary. Once a month the quantity of material issued (indicated on the lower part of the balance of stores sheet) should be recorded in the space provided for the rate of consumption. It is important to keep these records properly posted, as the figures are essential to the intelligent control of stocks.

The minimum amount is defined as the quantity of goods below which it is unsafe to go without taking steps to restock. The amount to order is defined as the amount of stock which should be requisitioned at any one time. Minimums and amounts to order cannot be set by arbitrary rules. If the monthly consumption is multiplied by the purchase time (expressed in months or fractions thereof), a useful basis for minimums is obtained. Similarly, a figure of twice the minimum has been found to be approximately correct. However, the importance of the article, its cost and the size of the standard package must also be borne in mind. There are, obviously, certain articles of stock, such as shuttles, picker stocks, etc., where the factor of safety must be large. On the other hand, in the majority of cases, minimums can and should be kept at a low figure. In general, frequent orders should be placed for expensive materials, infrequent for inexpensive. It costs about ten cents to do the clerical work incidental to the execution of a requisition and purchase order. This must be borne in mind and a reasonable balance struck, exclusive of rule, between the cost of an article and the cost of getting the order through. A very important factor in determining the amount to order is the size of the standard package, as in general broken packages are more expensive. This applies particularly when materials are sold by the dozen, gross, keg, box, barrel, gallon, ton, etc. However, care must be taken that the advantage gained by full package ordering is not more than offset by the interest lost through money tied up in idle stock. The determination of minimums and amounts to order requires careful work. The stores clerk should not be called upon to assume full responsibility. When a store is first started, minimums and amounts to order must necessarily be approximate. However, as soon as possible the mill manager should arrange to give his personal attention and that of his overseer to the accurate resetting of these important factors. The stores clerk is expected to see that no new article is carried in stock without the written approval of the mill manager, and that no minimum or amount to order is altered without the approval of the mill manager, and that no article carried in stock is discontinued without the manager's specific approval.

The upper right hand corner of the stores sheet is marked with a large letter "S." This letter is part of the symbol, which is used as an identification of a given article of stock. The title can be used for this purpose but as it is often lengthy and as its use may result in complications in the systematic arrangement of the balance of stores sheets, and the materials which they represent, for certain purposes it has been found convenient to use a symbol which is so conceived as to afford not only a positive identification of the article in question, but also a description of it. This symbol appears not only on the balance of stores record, but also on the bin tag. It is further used on the requisition and purchase orders. The purpose in every case is to assure beyond doubt that there shall be no confusion in transferring records from one form to the other.

In all our stores, mnemonic symbols are used. This system needs no detailed explanation, but a few illustrations of its use are given.

All office supplies are indicated by the letter A with the usual prefix S, designating stores. Under A we have other letters, such as E denoting envelopes; F, forms, etc. SA (K-45) F is one of our standard forms. SA (K3½ x 6¼)E is a Kraft envelope, size 3½" x 6¼".

The weaving department is designated by the letters SW. This, in turn, has subletters or headings denoting different divisions within that department. For example, D means draw-in machine; L, looms; S, slashers. A further distribution is used in the symbols for loom parts, as BY, battery parts; D, temple parts; L, loom proper parts; WSM, warp stop motion parts. Thus, a bobbin disc stud for a battery would be symbolized as SW (BY-985)L. The number is the manufacturer's pattern number.

Directly under the symbol appears a space for a second symbol, which is indicative of the location of the item in question in the stores bins.

The unit of issue is the unit in which the supplies are given out to the mill. The unit of purchase is that by which the purchasing agent buys the materials. These may or may not be the same. For instance, pencils are bought by the dozen or gross, but are issued by the piece. Care must be taken to avoid confusing units on the lower part of the balance of stores sheet, where the caption "unit cost" appears, the unit of issue is invariably taken as the base.

The lower half of the sheet showing the headings "on order" and "on hand," is handled in the same way as the debits and credits in bookkeeping.

Many other points might be developed. One of major importance and therefore deserving of mention here is inventory taking. It is necessary to take frequent physical inventories of classified and unclassified stores in order to be certain that any errors, resulting in discrepancies between the physical stock and the book records may be detected and corrected. This is most conveniently handled by a scheme known as "perpetual inventory." Under this scheme, a certain number of items of stock are counted daily. The number is fixed so as to allow for the checking of all stock items four times a year. Also, at four times during the year an actual book inventory is taken. The efficiency of the stores personnel can be determined by the number of adjustments necessary.

THE maintenance department is organized and operated for the purpose of maintaining the established standards as to equipment throughout the plant, upon which depends the performance of each productive operation in accordance with the instructions of the Planning Department, both as to the method to be followed and the time that such operations should consume.

Its function is *preventive* rather than *corrective*, and it is of the utmost importance that this viewpoint be kept constantly in mind by all parties concerned with the carrying on of the work of this department. . . .

Under scientific management the maintenance department is operated in such a manner as to anticipate and prevent in the greatest possible degree loss in output and interruptions to manufacture as a result of machinery and equipment getting in bad condition or breaking down. Under this system the maintenance department assumes the initiative and the responsibility which are thus centralized in one department instead of being divided and scattered throughout the plant. Under the old scheme the maintenance of equipment was only one of a great many things which the executives (superintendent, department heads and foremen) had to look after and it was well or poorly looked after according to the importance attached to it by the various individuals and the amount of time which other pressing duties permitted their giving it. Under the new scheme it becomes the matter of foremost importance to men who devote their entire time and energy to it in a consistent and systematic manner. (H. K. Hathaway, "Maintenance of Machinery and Equipment as a Part of the Taylor System of Management," *Bulletin of the Taylor Society*, Vol. III, No. 3, May, 1917, p. 7.)

Methods of Wage Payment and Market Comparisons of Wages

The Importance of Recognizing Differences in Methods of Wage Payment When Group Experience is Used as a Basis of Wage Comparison

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IT IS generally recognized, even though not always admitted, that wages or the prices paid for labor, are influenced, within limits, by forces of demand and supply, just as are the prices paid for other factors required in production. To take this view of wages is not to disregard the fact that labor is furnished by human beings.

This supply is influenced in part, but not alone, by the number of workers available for work of a given kind. Another factor which influences the supply of services is the duration of the working time; another, the efficiency of the workers.

While incentive methods of wage payment are built around the idea that the "exercised capacity" or efficiency of workers is not uniform, the fact remains that very little recognition has been given to this point when market data are used in connection with wage policies. Here comparisons are likely to be made on the basis of an average for all workers in a given occupation. That different methods of payment are only different routes to the same ends is a view implied and often expressly stated.

Interesting information in this regard is furnished by a survey made in April, 1927, among metal manufacturing plants in the Philadelphia area. While the entire survey[1] covered 25,459 employes in 83 establishments, attention will be centered here on a group of male employes operating seven standard machine tools.[2] In this group there were 1,456 men distributed among forty-three plants.

Three general types of wage payment were found to be in use. They were time, piece and bonus. Bonus methods were not uniform in their provisions and the term as used here includes all other than straight time and piece methods. It will be noticed from Tables 1 and 2 that these different methods are used quite extensively among both plants and occupations.

Not only are there different methods of payment but the hourly and weekly earnings are different under each method, as is shown by Table 3. Time earnings are lowest and bonus earnings highest. Thus for the combined occupations the average hourly earnings are 64.7, 70.6 and 78.7 cents for time, piece and bonus methods respectively, and $32.67, $35.79 and $40.53 respectively for weekly earnings. It will be noticed that piece earnings tend to be 10 per cent and bonus earnings 20 per cent higher than time earnings in both cases.

With the individual occupations there is not an instance where time earnings are not lowest and bonus earnings are not highest, although piece earnings are not consistently 10 per cent and bonus earnings 20 per cent higher than time earnings.

That hourly and weekly earnings are not the same for all methods of payment[3] but that time,

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[1] Miss Anne Bezanson, Associate Director of the Industrial Research Department of the University of Pennsylvania, supervised this survey with the assistance of Miss Miriam Hussey of the same department. The participation of the author was principally in regard to the occupations considered here. The detailed study will be published by the Industrial Research Department of the University of Pennsylvania in the near future under the title, "Earnings in Certain Machine Tool Occupations in Philadelphia."

[2] Boring mill, drill press, engine lathe, milling machine, planer, screw machine and turret lathe.

[3] The detailed study referred to in Note 1 will cover the following points: (1) actual wages in the selected occupations; (2) wages between plants; (3) relation of method of wage payment to wages; (4) relation of normal working time to wages; (5) relation of actual working time to wages, and (6) relation of length of service to wages. This analysis will show (1) that the tendency for time, piece and bonus earnings to increase in the order named holds not only for the market but also for the individual plants as shown by a frequency distribution of average hourly plant earnings; (2) that the tendency holds by occupations when only those men are considered who actually worked the normal time of their plants, and (3) that the tendency also holds when allowance is made for the differences in normal time of plants. A discussion of questions of statistical method and economic theory is anticipated in certain of the economic journals.

TABLE 1

DISTRIBUTION OF MEN BY PLANTS AND BY THE METHOD OF PAYMENT

PLANT NO.	TIME	PIECE	BONUS	TOTAL
3	1			1
4	14		31	45
5	1	10		11
6	2	11		13
8	2			2
14	4		32	36
20	15	23		38
23			14	14
25	26	38		64
26	22		54	76
31	11			11
32		57		57
35	12	196		208
36	3	10		13
37	13		33	46
44	11		45	56
46		58		58
49	21		31	52
53	5	5		10
54	28	16		44
55	2		31	33
56	35			35
57	1		10	11
63	21	116		137
208	8			8
209		1		1
211	4		28	32
227	31			31
323	2			2
347	1	7		8
400	9			9
475	10			10
477	1	4		5
529	5			5
570	11		1	12
604	1			1
646	4			4
674		2		2
710			17	17
717	2			2
765	25			25
773	16	182		198
815		13		13
TOTAL	380	749	327	1456

TABLE 2

DISTRIBUTION OF MEN IN SPECIFIED OCCUPATIONS BY METHOD OF PAYMENT

	TIME	PIECE	BONUS	TOTAL
Drill Press Operating	59	142	44	245
Milling Machine Operating	46	124	37	207
Planer Operating	23	16	19	58
Turret Lathe Operating	24	53	48	125
Screw Machine Operating	58	150	52	260
Engine Lathe Operating	148	161	103	412
Boring Mill Operating	22	103	24	149
TOTAL	380	749	327	1,456

TABLE 3

AVERAGE HOURLY AND AVERAGE WEEKLY EARNINGS BY METHOD OF PAYMENT FOR SPECIFIED OCCUPATIONS

SECTION A
AVERAGE HOURLY EARNINGS

	TIME	PIECE	BONUS
Drill Press Operating	59.2	64.2	68.0
Milling Machine Operating	63.7	67.5	83.3
Planer Operating	66.3	71.2	78.0
Turret Lathe Operating	66.2	70.9	75.9
Screw Machine Operating	64.3	72.1	80.0
Engine Lathe Operating	66.0	76.1	81.0
Boring Mill Operating	70.9	71.9	85.6
COMBINED OCCUPATIONS	64.7	70.6	78.7

SECTION B
AVERAGE FULL TIME WEEKLY EARNINGS

	TIME	PIECE	BONUS
Drill Press Operating	29.42	31.52	35.29
Milling Machine Operating	32.30	32.60	43.15
Planer Operating	35.07	37.45	40.25
Turret Lathe Operating	34.23	37.15	38.18
Screw Machine Operating	31.12	34.75	42.32
Engine Lathe Operating	33.46	40.79	41.31
Boring Mill Operating	37.29	38.61	44.43
COMBINED OCCUPATIONS	32.67	35.79	40.53

piece and bonus earnings tend to occur in an ascending order is a conclusion which is supported by a more detailed analysis of the present data and also for occupations other than those here considered.

What may account for these differences in earnings is a logical question but unfortunately there is as yet no satisfactory answer to it. That time earnings are lower than piece and bonus earnings is perhaps less surprising than that there is a persistent difference between piece and bonus earnings. And yet some employers have declared very emphatically that different methods of payment are merely different routes to the same ends; that wages are about the same under any method of payment. To such individuals all the findings here presented are contrary to their expectations. But to other individuals the more unusual feature is the difference between piece and bonus earnings.

In the absence of information which accounts for these differences some speculation may be warranted. In the first place it is conceivable that the ability of workers may tend to vary, at least in certain occupations, with the method of payment employed. This might be the case if one method of payment is better suited for some kinds of work where one grade of labor is used than for another kind of work involving a different grade of labor, or it might be the case because of circumstances surrounding the method of payment itself. Since bonus earnings tend to be higher and since they are, in the aggregate, about 20 per cent above time earnings, it is interesting to notice that a rather recent experiment among operators of taffy machines in England shows a difference of about 20 per cent in the ability of workers.[4] While this similarity proves nothing it is suggestive in that it causes one to wonder whether there may be a tendency to about 20 per cent difference in ability within a given group. If so, then one may wonder whether, in the selected machine tool occupations, the best grade of workers may be attracted by and receive earnings proportionate to their ability under bonus plans even though the technical features of these plans vary. This is, of course, very loose reasoning and can be thought of as nothing but suggestive.

It is also conceivable that there may be differences in the effectiveness of the wage plans in stimulating the efficiency of workers even when the workers have approximately the same grade of native ability. This might arise out of the fact that despite variations in technical features of bonus plans there appears to be in general more careful attention given by management to establishing standards and rates for bonus than for piece work.

It is well to remember that the foregoing analysis rests on actual earnings and actual working time in a period of one week. There is a possibility that such a period is too short to obtain a representative sample of earnings under bonus methods of payment. While there is evidence of this difficulty arising in particular cases there is no indication that such instances are numerous.

Whatever the reasons may be for these differences in earnings the fact remains that judged by the present study the differences appear to be very deeply rooted. Because of this entrenchment there is abundant reason for giving attention to the methods of wage payment in making market comparisons.

While these findings pertain to a local situation the analysis has been made in one of the large markets of the metal industry and nearly all the leading metal manufacturing establishments in that market contributed data. Consequently there is reason to suspect that the conditions shown in this market may be found in other markets also.

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[4] Wyatt, S., "Machine Speeds and Output," *Industrial Psychology*, October, 1927.

INDUSTRY does not affect wage-earners merely as persons possessing labor which they dispose of on a basis of time, skill, and energy. For most men and women, the conditions which surround Industry, and the output of Industry, represent all that is possible for them in the way of health, happiness, and life itself. Both as consumers and producers, they are affected by all that affects production. Their position, industrially, touches at some point, and usually more than touches, is indeed interwoven with, every relationship of their lives. It is as members of communities that the workers experience the pressure of economic conditions. As the community circle widens, the sum of influences affecting the well-being of its members is increased. As the circle of industrial relations widens, the sensitiveness of the inter-relationship between Industry and the Community is correspondingly increased. As both expand beyond the radius of local and national bounds, and become increasingly cosmopolitan in character and scope, world influences hitherto unknown come into play. (W. L. Mackenzie King, *Industry and Humanity*, pp. 30-31.)

How Personality Influences Selection and Placement[1]

A Brief Discussion Pointing to the Need for More Objective Methods of Personality Measurement and Better Methods of Personality Training

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Introduction

LET us first consider what constitutes selection and placement. Selection includes selection for initial placement, selection for training, selection for promotion, etc. Placement is closely tied in with selection, as the introduction of an individual to his work tends to overlap the process of selecting him. If selection and placement are to be effective, we must have at our disposal adequate techniques for the measurement of individual differences both in positions and in the men that are to fill them.

The techniques which have been developed for the purpose of measuring individual differences in positions include:

1. Organization analysis and synthesis, which results in an organization plan.
2. Job analysis and synthesis, which results in specifications for each class of position.
3. Class grading, which results in a grading plan of the various classes of positions.

The techniques which have been developed for the purpose of measuring individual differences in men include:

1. The interview
2. The psychological test
3. The rating scale
4. The medical examination.

The development and utilization of these techniques have indicated that personality plays an important role in the selection and placement of employes. The purpose of this lecture will be to discuss some of the aspects of the role that it plays.

Definition

Before discussing the influence of personality in the selection and placement of employes, we should, perhaps, define the word "personality." Unfortunately, a generally accepted definition of this widely used trait term has not, to the best of my knowledge, ever been formulated. To some, it means the sum of all of the traits possessed by an individual; to others, it signifies only a certain personal magnetism or personal acceptability. It would indeed have been helpful if the individuals who planned these conferences had established a definition for us. For the purposes of this lecture, however, let us narrow our concept to include only the combination of temperamental qualities which causes an individual to be personally acceptable—socially or vocationally—to his friends, associates, superiors, subordinates, customers, prospects, etc. We would include such factors as personal cleanliness, dress, mannerisms, emotional stability, introversion and extroversion, "mixability," etc., and exclude such traits as intelligence, general capacity, special capacities, specific skills, ethical behavior, etc. Although a critical examination of this concept would detect many flaws, I hope you "will know what I mean" when I use the term.

Organization Analysis and Synthesis

In the development of the organization plan for any given institution, it will be found that the different types of relationships require different types of personality. On the basis of organization, business positions classify as follows:

1. Executive
   a. Line
   b. Functional
2. Staff
3. Rank and file

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[1] From a lecture given at New York University, December 10, 1928, as part of a series on "Personality," under the auspices of the Association for Personality Training and New York University.

The line executive exercises direct control over the men who report to him. He is responsible for the execution of the work performed by them. He is the executive who handles dynamic operating problems. He must, therefore, possess the type of personality which will cause his subordinates to *want* to achieve the objectives of their jobs, of their department, and of the company. An example of this type of executive position is that of foreman of a processing department in a factory.

On the other hand, we have the functional executive who exercises functional control of the same particular factor necessary to operation. He represents the management in that he has the authority to approve (not disapprove) certain decisions of the line executives relative to such matters as methods, personnel adjustments, equipment, purchases, etc. He also renders specialized service to the line executives. He should, therefore, possess the type of personality which will enable him to co-operate with his associates and to win their confidence and respect. In other words, he must be able to "sell" his ideas to the line executives. An example of this type of executive position is that of comptroller.

It should be mentioned, however, that the line of demarcation between line and functional control is not always clear. The line executive often exercises some functional control and the functional executive usually has a working staff under his direct line control. There are, of course, various degrees of this overlapping. But we may say that, in general, executive positions tend to be either line or functional. The type of personality required in either case, therefore, should be given careful consideration in the selection and placement of executives.

Let us next consider the relationship of the staff man, who usually exercises neither line nor functional control but who may report to either a line or a functional executive. The staff man, as a general rule, is called on to make investigations, analyses, recommendations, and reports, but he does not have the authority of taking action on these matters. Examples of this type of position include research chemist, market analyst, auditor, industrial psychologist, etc. Even in this type of position personality plays a large part in selection and placement. With the exception of a few isolated positions, the researches of the staff man will bring him into contact with other people, either within or outside of the organization. It is essential, therefore, that he possess a personality acceptable to the type of person with whom he will come in contact.

What has been said about the staff position applies also, to some extent, to the rank-and-file position. Practically all of the incumbents of such positions come in contact with other members of the institution or with the public. It should be obvious, therefore, that the personality of each rank-and-file worker must be given due weight in selection and placement if both personnel relations and public relations are to be developed to a high standard of effectiveness.

Job Analysis and Synthesis

Job analysis and the development of class specifications for the various classes of positions may be considered as a refinement of organization work. The specification which is established for any given class of positions should indicate the objectives of those positions and the qualifications required of the incumbents. Included in the statement of qualifications should be the type of personality required. If possible, these standards should be in *terms of quantity* as well as quality. For practical purposes, however, it will probably be many years before research workers in the social sciences produce such measures, although, at the present time, some attempts have been made to indicate personality requirements in qualitative terms. Attempts have been made also to measure personality requirements in terms of psychological tests, but, in practically all of these cases, the standards have been expressed in terms of the tests rather than in terms of the position itself.

Although at the present time he appreciates the inadequacy of the techniques for measuring the personality requirements of the various classes of positions, the practical personnel man gives careful consideration to the apparent requirements of each position which he is called upon to fill. For example, he must consider the human contacts involved. Are they with associates in the same department; with members of other departments; with the public? Also, are these contacts in person, by letter, or by telephone? What is the social status of the individuals with whom contacts are made? And so on. Even at the present time, personality plays an important part in any job analysis that is made.

Class Grading

A class grading plan results from the grouping into grades of all classes of positions homogeneous in the nature and importance of their constituents and the arrangement of these grades in an occupational hierarchy based upon an appraisal of their *relative* value within the given institution. Such a plan is used to provide a definite basis for (1) the development of avenues of promotion and of logical transfer lines; and (2) the development of an equitable compensation plan. Class grading is an essential part of any program of promotion and of salary administration.

In the process of determining the grade of any given class of positions, the influence of personality is again felt. Included in the factors which determine the importance of a class are the kind and amount of human contacts involved. A class of positions involving an unusual amount of contact with a public group of high social status and requiring, therefore, a personality acceptable to the members of such a group would tend to receive, other factors being equal, a much higher grading than a class of positions involving limited human contacts.

The Interview

We have just considered the influence of personality in connection with techniques of measuring individual differences in positions. Let us now consider the role that personality plays in connection with the techniques for measuring individual differences in men.

The interview is the oldest and most widely used technique. Although it is not as reliable as we should desire, it will, nevertheless, always be a most essential device in measuring individual differences in men. It is here that personality plays a most important role. The interviewer must, if the interviewee is an applicant from without, give special consideration to the latter's general fitness for membership in the organization as a whole, in terms of those aspects of personality which will affect his relationships with the other employes. The interviewer must also consider the special fitness of the interviewe for the position for which he is being considered in connection with the personality requirements of this position.

It may be in order to mention the importance of an acceptable personality as a requirement for the position of interviewer. Successful selection depends largely upon the personality of the interviewer. An individual with an inadequate personality is probably not well qualified to judge personality traits in others. Yet, opinions have been advanced that an appreciable number of employment interviewers are sadly deficient in personality traits. I will not attempt to discuss these opinions except to mention that, on the basis of casual and haphazard observation, they seem to be partially justified. Management does not always seem to realize that it is a good investment to maintain competent interviewers that are personally accceptable to those whom they interview.

The Psychological Test

We again feel the influence of personality when we examine the development and utilization of psychological tests. Tests may be classified as follows:

1. Tests for general intelligence
2. Tests for special capacity or specific ability
3. Tests for character and personality.

We find in the last group a number of significant attempts to measure objectively this elusive thing, personality. Included in this third classification are such tests as the interest analysis, the free association test, the personal inventory, etc. Research work with these tests in such vocations as executive, salesman, etc., has been and is being pursued. It is hoped that the practical personnel man will soon have at his disposal tests which will assist him in predicting the personality behavior of applicants and employes.

The Rating Scale

The rating scale represents an attempt to make more objective and reliable the judging (and the recording of such judgments) of one person by another. Rating scales are being used more and more in business institutions. In the main, they are applied to estimates of the progress of employes, but they are also used to some extent in the judgment of applicants. It will be found that most rating scales include a number of personality items, such as, appearance and manner, co-operation, personal impression, etc.

Although rating scales represent a distinct improvement over the usual haphazard and ambiguous methods of expressing opinions of individuals, they are far from being satisfactory and reliable as they are used at the present time in business institutions. There is a real need for working out better rating devices.

The Medical Examination

The medical examination is important as an aid in determining whether or not an individual is physically qualified for a given position. Various members of the medical profession, however, (especially neurologists and psychiatrists) have extended their activities to include the diagnosis of personality differences in normal as well as abnormal persons. Psychoanalysis is used by some as a technique for measuring these differences. Although optimistic reports have been made regarding the superiority of the psychiatric method over the usual interviewing methods of skilled employment interviewers, doubt may well be expressed relative to the justification of such optimism.

In addition to the psychiatric interview, the recent studies of glandular activities in the human body have opened the possibility of measuring personality traits either by measuring the glandular functions directly or by way of the reflection of their activity in bodily development. Although the literature on this subject indicates that there is some relationship between personality and these obscure psychological reactions, it seems very unlikely that any techniques will be developed which will be of any practical value in the selection and placement of employes.

Conclusion

It should be obvious that personality plays an important role in selection and placement. Practically every technique used to measure individual differences in positions or in men is influenced by it. If this is true, there is a need for more objective methods of measuring the personality requirements of the various classes of positions and the personality behavior of applicants and employes. In addition, there is a need for better methods of personality training.

AS FAR as there is anything distinctive about scientific management, it represents a shifting of thought from machines to men. Whether rightly or wrongly, the claim of the system for special merit is based upon its seeing more truly the deeper motives that actuate men; upon its adaptation of factory conditions to conform more perfectly to man's comfort, productive efficiency, and satisfaction; upon its coming down more intimately to the temper and capacity of the individual worker. Scientific management is thus, first of all, a study of man, of his nature, of his ideals. It is based upon the principle that cheerful workmen are more profitable than sullen ones, that to fit the work to the man is better than to try to fit the man to the work. . . . As long as scientific management retains these ideals — and the lives of the leaders testify that they have practiced them up to date—it is hard to see how the system could be anything else than agreeable and beneficial to the workmen. (Horace Brookwater Drury, *Scientific Management*, 1922, p. 522.)

Job Analysis as a Basis for Teaching

A Study Showing How Job Analysis May Contribute to the Techniques of Education

By **EDGAR A. DOLL**
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Introduction

ONE of the most significant trends in education today is the shift from a stereotyped academic education to the much wider field of human endeavor. In our time the public school assumes many educational responsibilities formerly carried by the home and by the guilds. The almost revolutionary changes of modern civilization practically compel the school to carry the burden of providing formal instruction for nearly all phases of social adaptation with which the youth of today are confronted, a task which formerly was divided among all sorts of community agencies or else was left to individual adaptation in relation to individual growth and development.

Today we see the school educating its pupils, not only for living but also for a livelihood. We see it endeavoring to bridge the gap between the period of infant education and of adult civic responsibility. The traditional curriculum of the monastery, the classical colleges, and the private academies is giving way to the demands of an industrial civilization which will not be denied.

Coincident with this tendency is the tremendous extension of education from the few to the many. Formal preparation which only one hundred years ago was limited to the upper classes is now not only free to everyone but even compulsory. It is not surprising that an education designed for the masses should be different from that of the privileged classes. Neither is it surprising that the tremendous increase in the pupil body should result in a "quantity production" type of education. It is almost inevitable that education on such a large scale should resort to scientific technique in the interest of economy and efficiency. Our generation is, in consequence, witnessing a movement in educational engineering which quite properly utilizes the methods of industrial organization and scientific management, namely, (1) research as a basis for policy and practice, (2) modification and standardization of procedures based on the established facts discovered and formulated through research, and (3) supervision of practice supplemented by measurement of accomplishment.

Let us waste no time in regretting these changes, but rather let us do what we can to direct these tendencies from crass industrial and commercial exploitation, and continue to hold high the educational ideals of cultural and intellectual freedom. Education can no longer pretend to be a science unless it conforms to the essential tenets of all science, viz., observation and experiment, control of variables, and systematized organization of facts and principles.

The first steps of this efficiency movement were taken nearly one hundred years ago when the feeble minded were recognized as individuals having a right to a type of education especially suited to their peculiar needs and capabilities. Special education for the blind and the deaf led to this innovation. It is only within recent years, however, that these principles of differentiated education have been applied to gifted children. The amazing developments in psychology which have made possible the effective classification of all school children in ability groups opens educational vistas heretofore unseen.

Perhaps it is unfortunate that the more modern movements for classification of pupils is limited to an intelligence classification, yet there is but little doubt that a few more years will witness further elaboration of these principles by making possible classification according to social and mechanical abilities as well. The individual is something more than a thinking being. He must also live in social contact with his fellows governed by his feelings and emotions, and he must be a productive unit in an economic world as well.

Unfortunately, many educationists fail to see that classification is only a means to an end and that the differentiation of pupils in ability groups leads naturally to the more serious problem of differentiation in curricula. After classification, what? The immediate consequence of the classification of children according to intelligence is the revelation of differential educational objectives for these groups. The moron cannot hope to be president, nor will the child with an I. Q. of even one hundred become the intellectual leader of the day. The able few will continue to lead, and the less able many will continue to follow.

But if the public school is to fulfill its responsibility of directing social evolution for the progress of civilization it must educate both the leaders and the followers. It must develop the best talents of each group according to their native endowment and individual tendencies. In other words, the school must bring about a systematic correlation of individual native abilities with ultimate social and industrial activities, but in so doing it must not lose sight of cultural values, of intellectual freedom, and of political democracy. We dare not contemplate a system of education with blind alleys and closed doors any more than we dare continue the folly of assuming that every child who enters the kindergarten may some day be a doctor of philosophy.

Public Institutions as Laboratories

Our country has established numerous institutions for the care and training of various types of social misfits and for the physically handicapped. Most states have provided public institutions for the care and education of the criminal, the delinquent, the blind, the deaf, the feeble minded, the dependent, and numerous other socially handicapped groups. But in only a few states are these institutions truly educational and in practically none of them are the possibilities of experimental education being realized.

As one studies the tendencies in social and educational evolution, it becomes evident that particular classes of people are more and more receiving specialized care. This movement has already reached the public schools. Our leading cities now provide separately for crippled children, tubercular children, the visually handicapped, the anemic, the incorrigible and numerous other special groups of children. These special classes and those found in state institutions are usually faced with a much more highly specialized type of educational problem than is the undifferentiated public school classroom. The social outlook for the inmates of institutions is restricted in many instances. The more advanced of these institutions, following the newer developments in science and in education, are endeavoring to adapt their methods to the restricted futures of their inmates. In the institutions for the feeble minded, for example, experience has indicated that only a very limited number of these persons will ever be able to take their places in society, and that even these will require more or less supervision and will not rise above a very low social and cultural level. Those institutions which are performing their tasks most conscientiously and effectively have long since adopted the principles of classification, while some have recently conceived the notion of differential objectives.

In an institution for the feeble minded it is well known, and it can be predicted very early in the life of an individual, that idiots will never be able to do more than feed themselves and care for their bodily wants. Even the best of the idiots under the most promising methods of training do not learn to dress themselves, and do not develop any command of thoughtful speech. Likewise the imbeciles are incapable of learning anything but the simplest elements of reading, writing and counting, and make such limited progress that even these elements are hardly worth teaching. And among the morons it is well known that even the brightest of them only rarely become able to live independently in society. They never get beyond about fourth grade schooling and never acquire skill beyond the most mechanical or routine or elementary trade and industrial processes. In the education of these unfortunates, therefore, we dare not contemplate a visionary system of education. Instead we must constantly strive to extend the limits of their educational possibilities by increasing the efficiency with which they may be trained or taught.

Implications of Industrial Psychology for Education

Industrial psychology is one of the most recent branches of applied psychology and promises to exert a most significant influence on industrial life and commercial organization. Industry criticizes the efficiency of public education and its effectiveness as a means of preparing the youth of today for competent economic adjustment. It has even gone so far as to set up its own schools to educate its beginning employes. Professional educationists may well "view with alarm" this tendency of industry to commercialize education, but they will also do well to study the efficient methods by means of which industrial education strives to accomplish its specific ends.

One of the contributions of industry to education is the technique of job analysis. This method reached a high plane of educational development nearly thirty years ago when Mr. John S. Leech employed it in the education of native children in the Philippine Islands. That work, which apparently attracted little attention, revealed tremendous promise as an analytical system of specific education. Mr. Leech analyzed the printing trade into its various departments, its particular jobs, and its specific unit operations. On the basis of this analysis he organized a system of vocational education, the effectiveness of which was the crucial proof of its value and possibilities. We applied Mr. Leech's method with good results in 1920 in the vocational industries of the New Jersey State Prison and the New Jersey Reformatory. Unfortunately these results were not published except in descriptive form, but their value amply justified the method of approach. This same method is now being applied as a scientific approach to the problems of industrial education of the feeble minded at the Training School at Vineland. A complete industrial and vocational survey of all occupational training assignments at the Training School has been planned. The first of these studies is reported herewith as an illustration of the method's values and principles. We believe we are justified in the conclusion that this same method can be applied with equal if not greater success in the education of normal children not in institutions, and we even venture to predict that some modification of this procedure will be evident in the public education of the future. Mr. Bobbitt's[1] endeavor in this direction has already created a furor in educational circles. Although Mr. Bobbitt has not paid as much attention to educational values as he might well have done, that defect is a detail which can be corrected by further work in the field.

Principles of Job Analysis

In the industrial world job analysis is chiefly used as a method of industrial efficiency and industrial placement. The ultimate purpose of the analysis is to reveal the requirements of the specific unit operations in order that men may be selected for the work with a minimum of industrial turnover, a reduction in the period of "breaking in," and a more efficient production. An analysis has a number of definite steps according to the complexity of the administrative organization of the industry. In a large organization it is first advisable to analyze the industry as to its major departments, then as to its specific shops or subdepartments, and finally as to the jobs or the specific operations. The jobs are further analyzed as to their unit operations, and these unit operations are then analyzed if possible into their specific processes.

For example, in a large printing industry there will be a business department, a sales department, and a production department. Each of these departments will be divided into shops or subdepartments. Thus the production department will have a composing room, a press room, a bindery, and so on. In each of these shops or subdepartments there will be specific jobs. Thus, in the composing room there will be the job of linotype operator, hand-compositor, and so on. Likewise each of these jobs will have its unit operations. Thus, the hand-compositor must read copy, must set type, must throw type, and so on. And in each of these unit operations there are a number of specific processes such as motor co-ordination, form perceptions, memory processes, attention and the like. Thus in the unit operation of throwing type the operative must read the type, must recollect the pockets of the cases, must make certain co-ordinations in picking and throwing type, and so on.

The ultimate assumption of job analysis is that in the processes of industrial selection, i.e., employing a man for a specific job, it is possible to interview him, or to examine him, or to observe him in action, with respect to the specific unit operations. Under a system of micromotion study it is even possible to analyze the specific movement processes involved in performing the unit operation into their component elements. The job analysis may lead to industrial reorganization in the interests of commercial efficiency without reference to industrial education of the operative, although usually, of course, complete job analysis results in some modification of the operative's performance.

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[1] Bobbitt, Franklin, *"The Curriculum,"* New York, Houghton, Mifflin Company, 1918; *"How to Make a Curriculum,"* New York, The Macmillan Company, 1924; *"Curriculum Investigations,"* Supplementary Educational Monographs No. 31, Department of Education, University of Chicago, 1926.

From the point of view of the industrial psychologist job analysis should be paralleled by a corresponding man analysis. For the psychologist a unit operation and process may involve intelligence and personality as well as motor skill. Some tasks require care and judgment while others involve only perfunctory routine. Some tasks require variability in performance while others require monotony. Some require honesty, discreetness, or conscientiousness, while other jobs are independent of these traits. Complete psychological job analysis therefore involves more than an analysis of motor coordinations; it requires a study of the intellectual, educational, emotional, and other processes as well. In complete industrial selection, therefore, the candidate for the job must be examined in all these respects as well as with reference to his specific motor skill or industrial competence in the narrow sense.

The educationist is perhaps uninterested in job analysis as a method of industrial organization and placement. For him job analysis immediately suggests educational possibilities. For him the unit operations represent specifications to be met in the educational development of the individual and at once he devises a system of education or training designed to bring about the highest possible performance in the required tasks by an individual having previously no skill or less skill. This immediately becomes a field of operation for the industrial instructor whose business it may be to train young operatives in the most efficient performance of their duties after the industrial personnel officer has selected novices who give promise of becoming successful operatives.

It is safe to assume that specific industrial education should be left to the specific industry. Industrial education in this sense is not a function of public education. The instruction is often so specific to the particular industry and the variety of industrial methods from one organization to another so great that industrial re-education is frequently necessary for the operative who transfers from one organization to another. With the increasing specialization of industrial life we find employers frankly preferring to break in operatives in training methods under their own conditions. These employers ask all public schools to train in the more general industrial virtues, and the more general non-specific processes underlying industrial operations. We therefore find the public schools emphasizing the broader lines of trade training which give a man that general preparation for economic adaptation which will provide breadth of industrial outlook and such a measure of cultural education as is his right as a prospective citizen.

Job Analysis of an Institutional Dairy

To illustrate the above principles of job analysis, to justify the suggestion that such analysis may be used as an educational method, and to promote the idea of an institution as an educational laboratory, we now present a concrete study of a job analysis of dairyman training in an institution for the feeble minded.[2] The dairy is a subdepartment of the farm in this institution. Children are placed in it sometimes as an industrial assignment, sometimes for industrial training, and sometimes for general educational purposes. Obviously it is necessary, before differentiating these assignments as to purpose, to have some objective for the individual so assigned. This is determined by the fact that some of our children may expect to remain in the institution during the rest of their lives and that after they have outgrown the training period it is justifiable, in the interest of economy and their own happiness, to place them in an occupation which may be considered a lifetime job, just as every adult sooner or later settles down to an occupation in which he expects to spend the rest of his working days. In this same dairy we have other boys who may not be expected to remain in this institution during the rest of their lifetime. They have a prospect of release or parole which would apparently be increased materially if they were trained in this occupation. These boys are assigned to our dairy for a limited period, but with an industrial objective, which is not necessarily to be attained in this dairy but perhaps in some other. It is obviously necessary, therefore, to give this class of boys an opportunity to go through all departments of training in the dairy rather than to assign them some specific industrial task.

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[2] The investigational portion of this study was conducted by Miss Sue B. Stryker, Research Fellow, The Training School at Vineland, N. J.

A third group of boys may be assigned to the dairy on the assumption that this department provides a type of training which would be valuable in their general educational or personal development. These boys may be thought of as not having a permanent place in our particular dairy and perhaps as not even preparing themselves for dairy work outside our institution. They may be thought of as boys for whom the dairy provides an unusually happy situation in which to foster traits or habits, the achievement of which is desired without reference to their becoming dairymen. For boys like these the dairy offers certain occupational tasks which are common to many other industries, and their assignment to the dairy rather than to the carpentry shop is a part of this all-around vocational or industrial preparation. It is, in other words, general rather than specific. It is the difference between learning to read and reading to learn. This group of boys has, therefore, a materially different objective from the other two groups and the training motive is therefore different even though the training content may be similar. This is on the assumption that the motive behind education or training exerts a different influence upon the entire educational program of each individual. The fact that the training rather than the work accomplished is the object of the assignment should, we think, make an important difference.

This study, then, was undertaken in order to evaluate the industrial and educational possibilities of our dairy as an occupational, industrial, or training assignment. In order to evaluate the situation we made, first, a study of the department with reference to its organization, and second a study of the boys assigned to the dairy with reference to their capabilities and social outlook. Our study was further designed to evaluate the possibilities of systematic training as opposed to general training, and also to evaluate the correlation of abilities in the operatives as compared with their performance in the task. It seemed conceivable that a careful analysis of the work compared with an equally careful analysis of the workers might reveal ways and means of increasing the efficiency of both and lead to a more effective method of assignment and training in this occupation.

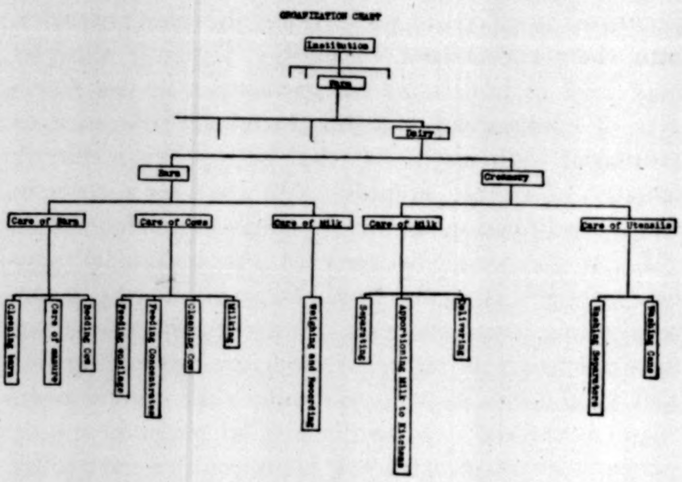

Figure 1

The administrative organization is important for the purpose of orientation. Figure 1 shows this organization. The farm is an executive department of the institution, and the dairy is a subdepartment of the farm. The dairy has two "shops," namely, the cow barn and the creamery. The work in the cow barn comprises three principal jobs, namely, care of the barn, care of the cows, and care of the milk before it leaves the barn. The creamery has two principal jobs, namely, care of the milk and care of the utensils. These jobs are further subdivided as to unit operations, as indicated on the chart.

This analysis immediately pictures the extent and limitations of this field of work as organized. It shows the specific "layout" for this particular dairy. This dairy is larger than some but not so large as others. Even a little familiarity with large commercial dairies will suggest important differences. It is at once obvious that the training possibilities in this dairy do not fully represent the work of the standard commercial dairy. For example, we neither pasteurize nor bottle our milk. On the other hand, we milk both by hand and by machine. Obviously a person receiving training in this dairy would gain only a general familiarity with the industry of dairying and would master only some of the operations common to all dairies. Such a person after training could probably adapt with but little difficulty in a dairy of a markedly larger organization and could find some place of employment. It might now be a question of administrative policy as to whether this dairy should be extended in all representative operations so as to make possible all phases of dairy training, such as the manufacture of butter, and the keeping of commercial accounts. One can accept the situation as it is or one can expand or curtail, according to one's educational ambitions.

The stage of analysis at which one rests may be a matter of convenience. Thus, one may consider the care of the barn as a job, and the bedding of the cows as a unit operation, or one may conceive of the bedding of the cows as a job, in which case the unit operations would be derived from a more minute analysis. The extent of the analysis depends somewhat upon the degree of specialization, and the degree of specialization depends on the extent of the industry. As a general rule the larger the industry the finer the specialization so that what is a job in one industry may be a unit operation in another.

Job Specification

In order to clearly understand the requirements for each job or unit operation, from a psychological point of view, it is next advisable to indicate the demands which the job makes on the operative with reference to such personal characteristics as intelligence, physique, education, personality and so on. In a scientific system of classification and training a child should not be put in training for which he lacks the necessary native abilities unless, indeed, the training is intended to develop those abilities. In continuing this dairy analysis we therefore prepared a job specification card on which could be checked the requirements for each of the jobs or unit operations outlined on the lowest level of the organization chart. In this initial survey only rough estimates of these requirements could be obtained.

Figure 2 gives a general summary of the principal requirements for each of the jobs in this dairy as now organized. At first glance these requirements do not seem very precise. This is partly accounted for by the fact that the survey was not based upon refined measures. In this table an intelligence rating of 1 was assigned arbitrarily to mental ages below 5; intelligence rating 2 was assigned to mental ages 5 and 6; rating 3 to ages 7 to 10 inclusive; rating 4 to ages 11 and 12; and rating 5 to ages above 12. The ratings assigned to the jobs were determined by the dairyman on the basis of his experience with children of known mentality and known success in the various jobs.

REQUIREMENTS FOR UNIT OPERATIONS

						TRAITS						
UNIT OPERATIONS	INTELLIGENCE	PHYSIQUE	SKILL	LITERACY	RESPONSIBILITY	CLEAN	CAREFUL	KIND	QUIET	INDUSTRIOUS	STEADY	DEPENDABLE
Cleaning barn	2	3	2	0	None	–	+	–	–	+	–	+
Care of manure	2	3	2	0	None	–	–	–	–	+	–	+
Bedding cows	2	3	2	0	None	+	+	+	+	+	–	+
Feeding ensilage	2	3	3	0	Slight	+	+	+	+	+	–	+
Feeding concentrates	4	2	1	2	Marked	+	+	+	+	–	+	+
Cleaning cows	2	2	2	0	None	+	+	+	+	–	–	+
Milking	3	2	2	0	Slight	+	+	+	+	–	–	+
Weighing and Recording	4	1	1	2	Slight	+	+	–	–	–	–	+
Separating	3	2	2	0	Slight	+	+	–	–	+	–	+
Apportioning	4	1	1	2	Marked	+	+	–	–	–	–	+
Washing utensils	2	2	2	0	Slight	+	+	–	–	+	–	+

Figure 2

It is not our point to justify the conclusions of this dairy analysis but merely to use it as an illustration of the principles involved. The details of the ratings on the other traits may, therefore, be omitted here. It is sufficient for present purposes to indicate merely the relative estimates of different abilities for different tasks. In this connection it is hardly necessary to say that the unit operations in this dairy are not highly specialized and therefore the range of abilities required is not very finely drawn.

It will be seen from this table that for some of the jobs physique is more important than intelligence, while in other jobs the reverse is true. In some operations literacy is imperative while in others it is not needed at all. The range of skill varies from employment of the grosser muscles to refined co-ordinations. The work varies in the degree of responsibility and of certain so-called personality traits, such as dependability, cleanliness and carefulness, required.

Abilities of Operatives

In order to correlate placement for training with the requirements necessary for successful job operation, we now enter the second stage of vocational analysis, namely, a description of the abilities of the persons assigned. In this dairy each boy has been studied with reference to his age, his performance on certain mental tests, his physique, his literacy and his personality traits. Since this study was based on persons actually receiving training, individual ratings of their general efficiency were obtained by means of individual classification cards, as well as from statements regarding the duration of their training in this department.

The results of the individual studies are presented in Figure 3. It will be noticed from this table that

ABILITIES OF DAIRY BOYS IN TRAINING

BOY	INTELLIGENCE	PHYSIQUE	APTITUDE	LITERACY	CLEAN	CAREFUL	KIND	QUIET	INDUSTRIOUS	STEADY	DEPENDABLE
A	3,3,4	2	2	2							
B	3,3,3	2	2	1	+	+	+	+	+	+	+
C	2,3,3	3	2	1	+	+	+	+	+	+	-
D	4,3,4	2	2	4	+	+	+	+	+	+	+
E	3,2,2	2	2	2	-	+	+	-	+	-	+
F	2,3,3	2	2	0	-	+	+	+	+	+	-
G	3,3,4	2	2	1	+	+	+	+	+	+	+
H	3,4,3	2	2	3	+	-	+	-	-	-	-
I	2,3,3	2	2	0	+	+	+	-	+	-	+
J	3,4,3	2	2	3	-	+	+	-	+	-	-
K	3,4,3	3	2	2	+	+	+	+	-	-	-
L	3,3,3	2	2	3	+	+	+	+	+	+	-
M	2,3,2	2	2	0	+	+	+	+	-	+	+
N	4,3,4	2	2	4	+	-	+	-	-	-	-
O	2,2,4	2	2	0	+	+	+	-	+	+	-
P	3,3,2	2	2	3	+	+	+	+	+	+	-

Figure 3

the boys now working there all have about the same general characteristics. There is not the same differentiation in their abilities as is evident in the requirements of the unit operations. This suggests what is actually the fact, namely, that the work of this dairy is not specialized as in an industry in which a boy performs certain specific tasks for industrial purposes, but rather that boys are assigned to this dairy on the assumption that they will receive training in all its unit operations. It is therefore necessary that they should have the highest abilities required by the most difficult operation in which they are expected to take training. In other words, boys are not assigned to this department for specific training in unit operations but for general training in dairy work. In only a few instances is the assignment purely industrial. The real division is not so much in the unit operations as it is between the work of the barn as compared with that of the creamery. Boys in the barn do not work in the creamery, and boys in the creamery do not work in the barn simultaneously; but boys working in the barn are expected to do some cleaning, some feeding, some milking, and so on. In other words, they share in common the various unit operations of the particular department to which they are assigned.

In general the policy of training obtains that whenever a child is expected to go through the steps of an occupation it is necessary that he have the abilities required in the highest steps unless, indeed, it is planned that he shall stop at some other level. This study seemingly revealed certain discrepancies, especially with reference to physique, which suggest that the correlation of operative with job is not entirely satisfactory. This lack of correlation is partly a matter of oversight, and partly a matter of exigency. Thus, a boy with insufficient physique for the work may nevertheless be assigned for the general aura of its training value, and such a boy is not expected to perform all of the actual physical labor involved but only the minor tasks. In other words, such a boy does what he can physically as well as mentally.

The analysis revealed in particular, however, the importance of personality traits, for all observers participating in this study agreed that cleanliness, carefulness, and kindness are desirable personal traits in this particular occupation. Industriousness, steadiness and dependability, while desirable, can be dispensed with because of supervision. This same analysis also revealed the possibility of using such an occupation in the development of desirable personality traits. A boy may acquire cleanliness, kindness, dependability, or any of the other traits, under training, since these are necessary to successful work in this occupation.

Training Organization

Our study of this dairy did not reveal a systematic training program for correlating the step-by-step processes in training. The job specifications show that some operations are much simpler than others, and the individual qualification analysis shows that if sufficient general ability is present it is possible to master all the operations. If the training is systematically organized, there should be some correlation in the individual's progress through the industry. Still more important, our study did not reveal a system of recording progress so that one could say definitely just how much success had been achieved in each operation.[8] Perhaps both these failures are somewhat explained by the comparative simplicity of work in this dairy, but the criticism may well be made that with a more efficient system of instruction it might be possible to reduce the job requirements and to use trained persons of lower individual qualifications. If this were done it would mean that we could increase the effectiveness of this training and could open new industrial opportunities to lower grades of children. Or, in other words, we could enlarge the industrial outlook of a larger number of children who are not now given the opportunity which they should have.

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[8] A system of recording progress in training with reference to these unit operations based on a more refined analysis is now in operation.

Implications for Education

This report is an argument for the principles of job analysis in education. The analysis is suggestive rather than conclusive and consequently challenges further and better work. It is conceivable that this general method need not be restricted to vocational and industrial training but will perhaps have even broader application in the analysis of manual and academic classroom teaching. We have begun our program of such a training analysis at The Training School with our dairy as the simplest and most readily accessible occupation. We see no barriers to applying the same method to manual classroom instruction as well as to academic classroom instruction. The analysis of academic instruction in terms of specific requirements and abilities will be relatively more intricate and will require more careful laboratory study. We predict, however, that the demands for the more efficient classroom instruction will ultimately force psychological analysis of our learning situations and that such an analysis will reveal in clear outline not only better and more specific educational objectives, but also some of the broader correlations with all-around individual development.

THE public schools ought to teach the basic requirements of all industries. This can be done if we have suitable job specifications to start with, from which by analysis, we can determine what things are fundamental and thus create curricula with suitable content. Job specifications are also of great value in selecting teaching material. One of the practical difficulties of using the world's work in the schools is that the teachers do not know what the world's work is. I remember when I was teaching physics—it used to be my subject—I saw a great many teachers of physics who were incapable of using the machinery and the applications of physics that are all around them in the classroom simply because they did not know what they were. They knew very little about the manifestations of physics in daily life. These specifications tell exactly what is done on every job. Thus they bring the teacher a content of definite material by which he can bring instruction close to the daily life of his pupils. (Charles R. Mann in *Business Management as a Profession,* edited by Henry C. Metcalf, pp. 137-138.)

IN PROPORTION as management comes to realize the prodigious complexity of the human element it directs, it will also realize that certain principles must be admitted, certain rights and obligations recognized. The worker does not sell his social birthright for the economic mess of pottage. Neither are his rights those of a primitive community, but rather the rights of a member of a civilized, educated, and democratic state. Both employer and worker have rights and corresponding obligations. Further, in so far as those rights are ethically dependent upon the due performance of function, the worker must share the rights and obligations of the management, if he be called upon to perform any part of the function of management, just as the manager must share the rights and obligations of the worker, if he be called upon to perform any part of the function of operations. The worker who is taken into consultation in matters of management must accept the obligation to formulate policy upon principles in harmony with the best interests of the community. (Oliver Sheldon, *The Philosophy of Management,* p. 84.)

Specimen Chapter

From "Scientific Management in American Industry"[1]

CHAPTER XVI

LABOR STANDARDS[2]

THE effort to establish operating standards in the several functional departments of an organization should logically not stop until standards are set throughout the field of personnel activities. But the difficulties of deriving objective standards in this field are such that the definitions which can be made at this time are really suggestive and prospective rather than closely accurate.

The range of activities for which standards have to be found is so extensive and covers so many lines of effort in which experience has not as yet suggested a valid criterion, that a statement of what standards are needed is almost as far as one can go. The conspicuous exception to this statement lies in the field of selection where much work along this line has been done. This may well be drawn upon in order not alone to suggest how standardization is progressing there, but also to suggest the kind of attack which must and can be made toward the setting of standards in the other personnel functions. From the point of view thus set forth, it should be possible for the reader to see how in the fields of training, health and safety work and the other activities, the idea of deriving new standards can gradually be followed through.

First, however, certain general considerations should be presented as a background for the subsequent discussion.

Principles of Labor Standardization

Individuals of every type of labor seek to attain certain human satisfactions and so far as possible to obtain them with the minimum of effort. The strength of the motivating desire in a measure corresponds to the degree of effort put forth. The effectiveness of the effort appears in the products of that effort. Human energy not properly applied produces results poorer in quantity and quality than are produced when it is efficiently applied.

Labor loss is increased when there is a sense of dissatisfaction resulting from misapplied energy or from other causes. Proper adjustment to kinds of work, as well as skill, is thus essential in producing the best. This adjustment involves a determination of the capacities of the individual and of the types of capacities that find satisfaction in different kinds of work. The problem is complex. In its simplest form it involves analyses of the abilities of each individual and of types of work to be done. To obtain a successful combination demands not alone that the best ability of an individual, or the best individuals, be considered, but that those abilities be used which, when applied to the task, result in continuous satisfaction. A task that requires average intellectual ability will often be badly performed by one of great ability or by one of little ability. Each of these will be maladjusted and dissatisfied. The increasing use of mechanical means of production only makes more important the requirement of the right human adjustment at each job.

The fundamental principles of labor standards rest on the above considerations. That individual engaged in work who feels that results are commensurate to his efforts and who finds his satisfactions in line with his ambitions, is well placed. This condition is concretely expressed in terms of individual and group production. Questions of quantity and quality of finished product are discussed in other chapters. Yet to enable the industrial psychologist or employment executive to proceed with his work these standards must all be expressed somehow in terms of human behavior.

But human behavior is a variable. It is characteristic of man that he can exist in a wide range of conditions. This fact must be kept in mind throughout the following discussion. This particular capacity is commonly spoken of as adaptability.

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[1] To be published by Harper & Brothers for the Taylor Society. See table of contents on the outside back cover of this issue.

[2] By C. S. Yoakum, Professor of Personnel Management, School of Business Administration, University of Michigan, Ann Arbor, Michigan.

In addition to being adaptable and variable within wide limits, he varies from his fellows. This fact of individual differences supplies the basis for the mental measurement efforts which have been rapidly extending in recent years.

Individual variability lies in the foreground of many problems of labor relations. The total situation in which a man works may make many changes in his attitude that are unaccounted for by the simple measurement of his individual capacities. In what follows, therefore, we shall speak of measurement and analysis of capacities, knowing that the particular individual or group has not been entirely stabilized by our best efforts to place him in the right vocation or position.

The process of establishing labor standards involves consideration of the man, his tools and his job. We are concerned here primarily with those techniques which are used to analyze the first of these—the men. The criteria of successful existence as a worker and of making a profit in money and satisfaction must be met co-ordinately with the standards dictated by the man analysis. Discussion of these will be found in the chapters on personnel planning and control, labor audits, and employer-employe relations. These other criteria thus set up become the second term in the mathematical equation which we must solve. The first term is the facts we can discover by studying the man.

Methods of Analyzing Human Capacity

Methods for analyzing human capacity are relatively new. The psychological laboratory is scarcely fifty years old. The highly complicated nature of man has thrown many difficulties in the path of the research worker in this field. Even so, it is surprising to note the rapid increase in use of laboratory methods. Attempts to apply the results of these methods are still more recent. Munsterberg began his studies in applied psychology almost forty years after Wundt established the first laboratory in 1874. The World War hastened the interest in human capacity and gave opportunity to test certain findings of the laboratories on a large scale.

1. *Capacity Tests.* The testing program from which labor standards can be derived may be conveniently presented in two major divisions. There are first those tests and analyses which seek to determine the capacities of an individual or group of individuals. These capacities or abilities or aptitudes indicate fields in which individuals are most likely to become proficient, be successful, and be satisfied. The standards so derived will necessarily be rough standards unless the capacity called for by a job is highly specific. They are, however, important as indicators of the probable future value of the individual as an employe. These inherent ability analyses are sometimes grouped into general ability standards and special aptitudes.

The most frequently tested ability is commonly called intelligence or intellectual ability, the ability to understand, to learn, to profit generally by experience. Tests which attempt to determine the relative amount of this ability have been variously called psychological tests, intelligence tests, mental alertness tests, or simply general ability tests. Other general abilities on which attempts at analysis and measurement have been made are mechanical ability, social ability—the ability to get along with others, emotional status and temperament, and character or moral status.

The group of special capacity factors to be examined in the effort to establish standards is usually referred to as special aptitudes. Outstanding examples of these are often found in the arts, such as music, painting, sculpture. Others that may be mentioned are special memory for numbers, ability to calculate rapidly, various mechanical aptitudes. These are often found necessary for success in certain jobs or parts of jobs so that it is frequently profitable to devise tests for departments of a business or industry and for specific jobs.

2. *Proficiency Tests.* The second major division of a testing program is the measurement and building up of standards for proficiency. These are commonly grouped into educational attainment or knowledge tests, and trade tests. Each group is intended to indicate the amount of information and degree of skill available in those persons who claim previous training and experience.

3. *Construction of Tests.* The techniques for building the various tests must be thoroughly understood. Briefly, a test must contain interesting material, or the individuals tested must be properly motivated prior to and during the testing process. The content of the test may be built out of material related to the subject's knowledge or work for the general ability tests. For the others the content of the test will more naturally bear on their inter-

ests, special abilities and occupations. It must be given under conditions as natural as possible. Reasons for it should be clear and unequivocal. If given to groups of employes, results should not alter existing conditions except as a standard for accessions and layoffs in the regular course of employment. The reliability of the tests should always be known, that is, whether a given test when repeated would give similar results or not. Scoring procedures should be so standardized that persons scoring the examination papers independently will obtain like scores. The above techniques are important in preparing the test.

4. *Validity of Tests.* The fundamental requirement of a test is its validity. Does it select the persons who are fitted for the work? Does it rank workers according to their ability to do the work? Will it predict?

Mathematical calculations are necessary to determine reliability and validity. Suppose these indicate satisfactory results. Shall we use the test in selection and placement? There may be more expeditious and cheaper methods available. Usually these will not produce objective labor standards such as are available from a valid test. If such standards can be established without the use of any form of test and be used more rapidly and more cheaply the test would be superfluous. A successful test must increase our success in the accurate handling of the employment process.

Mental Alertness Tests

Mental alertness tests have appeared in numerous forms since the war period. The majority have been devised for testing numbers of individuals in groups. Most of them can, however, be used to obtain data of value in individual cases. As an illustration of a simple type, we give here the instructions and sample questions from Bureau Test VI. This test is based on Army Alpha, the test used in the selection and placement of recruits in the United States army during the war. It does not use Parts 1 and 3 of the army test. Instead of keeping the items or questions in groups, the questions are mixed or "scrambled." The instructions are written out in full and read through completely before the subject writes any answers. Practically no writing, beyond a few numerals, is required. Four minutes is allowed for reading the instructions. When the group is unfamiliar with such tests a longer time may be permitted. The test may be given and standardized with or without time limits. Best results seem to be obtained in this case by the use of time limits.

Tests similar to these (illustrated in Figure 1) will usually be found useful as a preliminary in any group survey of applicants or workers. The data are easy to obtain and can in many cases be with profit made a regular part of the employment routine, provided they are administered by people thoroughly trained in their use. In conjunction with special ability tests and the trade test they can gradually be formed into labor standards of great value.

In certain instances, such as clerical work of all grades, some type of mental alertness test has thus far proved to be the best single criterion. As a measure of learning ability under every variety of condition, it seems to be the most generally reliable test. As a standard to parallel increasing complexity in a series of positions, it comes nearest to predicting those who will drop out because of the greater difficulties involved.

This relation between average test score and classification of the job on the basis of complexity can be seen in the following table (Table 1).

TABLE 1[a]

Average Test Score and Classification of Job

Grade of Work	Average Score
A (Office Boys)	52
B	91
C	118
D	102
E	107
F	113
G (Supervisory)	130
Typists	90
Stenographers	106
Secretaries	120

Grade C is largely composed of an emergency group of workers, many of whom were slated for promotion at the time the tests were given.

When compared with ratings of supervisors it is found that in general those clerical workers making the higher intelligence scores receive superior ratings on efficiency. Two things occur with respect to permanency of service. Persons who make high scores on the test remain if their promotion is fairly rapid or assured. Those who test low and yet are hired for relatively complex jobs fail to give satisfaction and are quickly dropped from the force.

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[a] Adapted from Table 2 in "Psychology in Business," *Annals of the American Academy of Political Science,* Vol. CX, 1923, p. 65.

Precisely similar results were found by the use of a test of the same general type in factory work. In a department where the job specifications indicated need for average intellectual ability in addition to skill, workers with low mental test scores and those with high test scores both showed higher turnover rates than those with intermediate test scores. In another department both average and

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DIRECTIONS

Inside this booklet you will find a lot of things to do. Samples of all the different kinds of things to be done are given below. Read the samples and directions carefully.

(a) How many men are 5 men and 10 men? **Answer (15)**
Write the correct answers to such problems, as indicated.

(b) good—bad **same—opposite**
The words "good" and "bad" are opposite in meaning, and the thing to do, therefore, is to underline opposite, thus: good—bad **same—opposite**
little—small **same—opposite**
The words "little" and "small" mean *nearly* the same thing, and, therefore the thing to do is to underline **same** thus: little—small **same—opposite**

(c) a eats cow grass **true—false**
These words can be arranged to form a sentence, as follows:
a cow eats grass.
This is a true statement. Therefore the thing to do is to underline **true**, thus:
a eats cow grass **true—false**
Do not write the sentence.
horses feathers have all **true—false**
In this case, the words, when rearranged, make a false statement:
all horses have feathers.
Therefore, the thing to do is to underline **false**, thus:
horses feathers have all **true—false**

(d) 2 4 6 8 10 12 ....
If the plan in this series of numbers were carried further, the next two numbers would be 14 and 16. Therefore, the thing to do is to write **14** and **16** in the two spaces provided, thus:
2 4 6 8 10 12 ..**14**.. ..**16**..
1 7 2 7 3 7 ....
To carry out this plan you should write **4** and **7** as the next two numbers, thus.
1 7 2 7 3 7 ..**4**.. ..**7**..

(e) sky—blue::grass—**table green warm big**
Here the thing to do is to underline the word that is related to "grass" in the same way that "blue" is related to "sky." Blue is the color of sky. Therefore, **green** should be underlined, because the color of grass is green, thus:
sky—blue::grass—**table green warm big**
Monday—Tuesday::January—**year November Sunday February**
Tuesday comes next after Monday. Therefore, **February** should be underlined, because it comes next after January, thus:
Monday—Tuesday::January **year November Sunday February**

(f) People hear with the **eyes ears nose mouth**
Here the thing to do is to decide which of the last four words makes the sentence a statement of fact, and underline it, thus:
People hear with the **eyes ears nose mouth**

When the signal is given, begin at top of the next page and work through the remainder of the booklet.

Work rapidly. If you are not sure about something guess at it, and go on to the next thing. There are no "catch" questions.

Do not ask questions. You are at liberty to refer to the directions at any time, but to do so oftener than necessary will waste time.

You will be allowed fifteen minutes. You probably will not be able to finish in the time allowed, but do as much as possible.

Do not skip about. Items skipped will be counted wrong.
Do not turn over the page until the signal is given.

Begin Here!

(1) How many are 50 tents and 8 tents? **Answer ( )**
(2) white—black **same—opposite**
(3) bird—sings :: dog—**fire barks snow flag**
(4) dogs meat eat **true—false**
(9) 2 3 4 5 6 7 ....
(11) The Merino is a kind of **horse sheep goat cow**
(178) cardinal not cultivated virtues the be should **true—false**
(179) 4 8 10 20 22 44 ....
(180) pertinacious—obstinate **same—opposite**
(181) advice—command :: persuasion — **help aid urging compulsion**
(182) A commission house which had already supplied 1,897 barrels of apples to a cantonment delivered the remainder of its stock to 27 mess halls. Of this remainder each mess hall received 56 barrels. What was the total number of barrels supplied? **Answer ( )**
(183) A five-sided figure is called a **scholium pentagon parallelogram trapezium**

Figure 1

high score workers presented high turnover rates. In a third department the highest turnover rate occurred among those of average score. A study of the job specifications of this department showed that it contained two types of work, one involving routine operations and another calling for a large amount of diversity of response, perceptual discrimination and judgment. In the above cases several different optimum scores would become the standard as to the amount of mental alertness required in applicants.

These brief illustrations present principles familiar to anyone who deals with job specifications, with materials' specifications, with standards of inspection, and so on. Objectives are set up, such as ability to do the work, a range of efficiency in doing it, a certain degree of permanency, the possibility of promotion to greater degree of responsibility (more complex jobs), and satisfaction of the individual at work. The tests and other methods of selection and placement are invented, investigated, and standardized with reference to attainment of those objectives which are deemed most important.

Special Aptitude Tests

Within the standard ranges of general ability, whether these ranges be determined for intellectual, mechanical, social, or temperamental capacities, it is often valuable to seek for special aptitudes with reference to individual jobs. In certain cases, such as musical talent, the analysis shows the special aptitude to be a highly complex group of special abilities. In other cases one or more relatively simple factors suffice to place the operator high among his fellow workers. We present one of these simpler operations to illustrate the procedure.

The test is one of finger dexterity. The workers, largely women, are assigned to fine meter or instrument assembly work. The test was standardized on 1021 women, during a period of three years.

Specifications for Apparatus[4]

Use three hundred brass pins, 0.072 inch in diameter and one inch in length; and a metal plate seven-eighths of an inch in thickness, five and three-fourths inches wide by twelve inches long. In one half of the plate drill one hundred holes, arranged in ten lines of ten each, one-half inch apart both ways; depth of holes, three-fourths of an inch; diameter of holes, 0.196 inch (No. 9 drill). The other half of the plate consists of a shallow tray approximately five by six inches with gently sloping sides so that the pins cannot be lifted by gathering them against the side of the tray.

Directions

Show candidate the pin board with three hundred pins assembled, three in each hole. Say: "There are three pins in each hole. I will tip them all out and get you to put them back, three in each hole, as fast as you can. Use only your right hand. Try to pick them up three at a time because you cannot go fast enough taking them one by one." Allow candidate to place thirty pins, thus filling up ten holes for practice. Tip out these thirty again, allow a moment's rest and then time accurately with a stop watch in minutes and hundredths of minutes the time required from placing the first pin to the last. If either two or four pins are assembled by mistake in one or two of the holes do not count against the candidate, and if because of such a mistake two or three pins are left over at the end do not require the subject to find where these pins belong and assemble them. The test measures finger dexterity, not accuracy in counting.

The percentiles based on 1021 women and 158 men are:

Rates	Women	Men
Fastest Speed	5.70 minutes	5.70 minutes
25 percentile	7.10 minutes	7.70 minutes
50 percentile	7.70 minutes	8.30 minutes
75 percentile	8.30 minutes	9.00 minutes
Slowest speed	over 15 minutes	over 15 minutes

Seventy-seven women engaged to do fine meter or instrument work distribute themselves as shown below after being given full opportunity to succeed at the tasks:

Quartiles Based on 1021 Cases	Scores	Percentage of Successes at Actual Work	Percentage of Failures at Actual Work	Percentage of Terminations Including Failures
1	0 — 7.10	88	0	12
2	7.11 — 7.70	89	0	11
3	7.71 — 8.30	50	29	50
4	8.31 or more	40	40	60

The writers say further: "Regardless of whether or not one believes in tests of this character, the employment manager who has among his selections no failures and 11 or 12 per cent leaving, is more successful than one with 29 to 40 per cent failures, and 50 to 60 per cent leaving. This result can be accomplished by selecting applicants who score above the median in such a test as this." Subsequent use of the test in selection has shown the validity of the standards thus established.

In the laboratory, the psychologist has developed numerous special measures designed to analyze the various mental factors. Experimental procedures are available for analyzing such characteristics as motor capacities, sensory processes, and learning, perception, memory, reasoning, ingenuity and imagination, temperament, character. But few of these have yet been adapted to practical industrial use. Undoubtedly all of them will gradually find a place in the development of labor standards in many types of work. Methods of formulating job specifications do not as yet readily lend themselves to the type of analysis necessary to specify the particular mental process or group of processes essential to a specific task.

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[4] Hines, Mildred, and O'Conner, Johnson, "A Measure of Finger Dexterity," *The Personnel Journal*, Vol. IV, 1925-26, pp. 379-382.

Two of the most interesting of recent attempts to analyze and adapt measures of human capacity to vocational adjustment are the interest analysis test and the social relations test. The first undertakes to show by individual responses to a large number of ordinary life situations that the reactions of persons successful in one of the professions or trades are significantly different from the reactions made by one in any other trade or profession. The social relations test endeavors to segregate those factors which make for easy and successful adjustments between individuals. Both types of test show promise of eventually being useful additions to what has already been accomplished on the general labor standardization program.

Information and Skill Tests

In contrast to the above types of tests the trade test and the information or knowledge test seek to determine the degree of skill or the understanding of the processes performed. Tests of these kinds would, in the above example, be based directly upon the work done by the seventy-seven women actually on the job. If applicants claimed previous experience, the tests would be applied to determine the degree of skill attained and the extent to which the applicant understood the work to be done. Such tests are designed to measure acquired abilities.

The types of trade tests are oral, written and performance. Any one of the three may be used to gauge either the skill or the knowledge of the candidate. If skill is to be judged, use of the oral and written tests is based on the close relationship which exists in most cases of expertness between knowledge about the job and the ability to do it. Such a statement is, of course, limited in its application primarily to skilled trades and to candidates who claim experience. It was found, for example, that performance tests only would give a safe estimate of the truck-driver's skill. The knowledge tests have been most highly developed in the United States within school systems or in corporation schools.

Such tests are difficult to construct. The limits of validity and accuracy are more closely drawn than in the case of capacity tests. This fact indicates, not that it is a simpler task to construct general and special capacity or aptitude tests, but rather that we know less about the mental aspects of the criteria with which they should be compared than we do about the other aspects.

A further difficulty arises in respect to trade and specific information tests. Trades in general have fundamental principles, but the modifications of them in different factories and to different materials make it hard to construct a test free of the peculiarities of the specific job. If successful in this latter respect the test may fail of its special purpose of enabling the employment manager to select men fitted for jobs within his plant. Probably the best solution of this difficulty lies in the co-operation of industrial concerns in building their job specifications and in setting up standard requirements on the basis of tests also constructed co-operatively.

The problem is largely one of developing the necessary skill in the preparation and standardization of these tools. Considerable acumen is also essential if time and money are not to be wasted in working on standardizing data for departments which can be left to the last. An ambitious program can easily fall to the ground under its own weight. Improperly started it will engender more hatred and opposition than almost any other action of management. One of the simplest illustrations of this occurs in giving a test involving language or terms not thoroughly familiar to the subjects. Picture tests and non-verbal tests of several types have been devised to meet this difficulty. Some of these do not require the use of verbal language on the part of either the tester or the testee. The introduction of a labor standardization program should proceed with the most obvious competitive devices in the beginning. Those used should be so carefully prepared that they can be handled by men well known to the candidates, such as foremen, assistant foremen and even by the workers themselves.

Other Devices

Three other devices have been used in developing standards for employment and placement: the personal record, the interview and the rating scale. These devices collect less objective data considered of value either as records or for the process of placement. They do not admit of the same type of standardization as do tests. However, the personal touch that is lacking in tests is supplied in these more intimate records. It is important, therefore, to determine as accurately as possible the significance of the data collected by these forms.

1. *The Personal Record.* Practically every company makes use of some form of application blank or personal record form for its employes. It may contain a few simple matters such as age, marital status, previous experience and education, or it may have dozens of items. Such forms are usually the product of what some particular employer thinks he wants to know about an applicant, rather than the result of careful investigation of the significance of various items of information. A standardized program of selection demands that each item on the application form shall have some value, some demonstrable significance in separating good prospects from poor. Indeed every item, whether in regard to mental characteristics, interests, or character, should prove its usefulness in separating the wheat from the chaff.

An illustration of the composite photograph obtained from a study of personal history items furnished by insurance salesmen shows the final steps in evaluating such a form. The multiple correlation figure obtained from combining a portion of these data and production records is +.40.

The average life insurance salesman who filled out the questionnaire is in his thirties, is five feet nine and one-half inches tall, is married at the time of contract, has two children, has gone to high school or college, has been out of school about fifteen years, has had four previous jobs, is apt to have been in insurance, the professions outside selling, clerical work, or in business for himself before beginning to sell insurance; has stayed about seven years in some one of his previous positions. He belongs at present to three or four clubs, is a member of a church, and usually holds one office. He has been selling life insurance from five to six years. He has had about one year's experience selling products or services other than insurance. He carried $3,000 insurance when he came with the company and now caries about $9,000.[5]

If we assume that application forms are only filled out completely by those applicants who appear, on the basis of an interview, to be worth hiring these records may serve as valuable sources of future labor supply and also as checks against reapplications. It is understood, of course, that the validity of these records as a basis for selection can only be established by performance records of the employes over a considerable period on the job. These subsequent records on the job become the really informing personnel records.

2. *The Interview.* The interview has not thus far been successfully standardized. The literature of employment methods is full of general discussions relating to its place in the process and many shrewd observations are made relating to procedures. It would take us too far afield to bring together here anything of value to the establishment of labor standards. Researches now in progress should, however, greatly improve the technique of the interview and finally enable us to standardize certain aspects of it.[6]

3. *The Rating Scale.* Much work has been done in the attempt to increase the reliability and the validity of the rating scale. This instrument is used in some form in all those instances where records are desirable, but the data do not readily lend themselves to quantitative and objective statements. Numerous forms of scales have been developed. The form probably most extensively used is known as the graphic rating scale.

An illustrative item from one such scale is given below:

1. How does his appearance impress you, especially his facial expression, physique, carriage, and neatness?

Creates fine impression	Good appearance	Appearance satisfactory	Gives somewhat unfavorable impression	Makes a poor appearance

Instructions to the rater are: "Read and consider carefully all the descriptive statements under the line before attempting to record your opinion. Indicate your opinion on each quality by making a cross (X) on the line just where you think it ought to be. For example, if in Quality 1 you think the prospective salesman is a little lower than indicated by the statement 'appearance satisfactory' but not quite low enough to be recorded 'gives somewhat unfavorable impression,' then put the cross on the line somewhere between these two points."

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[5] Prepared by Dr. Grace E. Manson. Used in Kenagy, H. G., and Yoakum, C. S., *"The Selection and Training of Salesmen,"* New York, McGraw-Hill Book Company, 1925, p. 241.

[6] Bradshaw, Francis W., "The Interview: A Bibliography," *The Personnel Journal*, Vol. 5, 1926, p. 100.

Such a scale can be treated statistically in a variety of ways. The qualities may be weighted in any manner desired, or they may be used simply for general comparison without being quantified. If one wishes to treat the data numerically, each line may be measured from the left to the position of the cross by a ruler divided into as fine divisions as desired.

Numerous cautions must be observed in the construction and use of such a scale in order to give it any validity whatever. Although both reliability and validity are never high, the scale is an excellent means of giving permanent form to one's impressions and opinions. Where several persons act as judges and fill out blanks independently, reliability will be increased. It also offers a means of comparing judges who, if they happen to be supervisors, foremen or department heads, are then themselves rated on ability to judge others.

The rating scale is an illustration of an instrument which can be used both in the process of prediction for selections and placement and as a part of the employment record. Obviously it should not be solely relied upon where objective data in the form of tests or production records are available. Its use lies in recording impressions and opinions on qualities of behavior for which no objective techniques of measurement exist.

4. *Training Records.* In many business and industrial companies an intermediate stage for the employe has grown up either between employment and beginning production, or before placement, or as a preliminary to promotion. This is the training period. During this stage of adaptation of the employe, records of his proficiency in learning, of his probable aptitudes and interests, are usually kept. From these data assignment to duties takes place on more intimate information concerning capacity than where the employe is placed immediately upon hiring, or transferred without preliminary training.

Under these conditions all of the standard measures above described must be adapted so that they will throw light on probable progress during the learning period as well as predict degree of success when finally placed. The training period is in itself an excellent criterion of future production, provided essential records of progress are carefully kept. Nevertheless, training is an expensive period of non-production. It is important to reduce it to a minimum. Hence the use of all standards having a fair degree of validity, in assigning individuals to appropriate training courses, is justified.

General Considerations

A successful and useful labor standard is one that correlates with performance. The necessity for adequate performance records becomes obvious. But performance records which actually group employes into reliable groups according to satisfactory service are difficult to obtain. No single form of measure has thus far proved statistically reliable. Numerous criteria of success have been tried and in separate instances certain of these seem fairly useful. Foremen's ratings; various forms of production records, including total pay received, amount of bonus, quantity produced, quality; point systems of weighting results; terminations or length of service, and rate of advancement, have been used singly or in combination.

Difficulties in the use of ratings have been noted. Questions arising in the use of production figures include different conditions of work, different degrees of experience with machines and materials, motivation of the worker, customary limitation of output, and so on. It is true these do not affect the establishment of production standards in bulk, but they do seriously affect correlations between test results and individual production figures. A few terminations may be definitely due to unsatisfactory work, but labor turnover figures of themselves lack that reliability essential to a true criterion. Permanency or length of service is somewhat better, yet it too is complicated by transfer and promotion to new operations which may not have appropriate test records with which to compare. It is also essential to know the relative importance of the several criteria of success if a combined score is sought.

Illustrations of the solutions that have been attempted would require too much space. Enough has been said to show that rough and ready judgments cannot be relied upon. Scientific management in trying to build up labor standards must be ingenious, scientific and persistent. A noteworthy sample of such a procedure is cited in the reference given below.[7]

All the factors considered above are also strongly affected by the environment of the employe. This environment includes his home and community surroundings, his physiological and emotional status, and the physical conditions in which he must work. It is not within the scope of this chapter to discuss these important features of labor standardization. Unless a favorable condition exists, however, with reference to these factors, attempts to develop the standards here described will amount to little. Wide variability exists in such simple items as eyesight, hearing, muscular power, nervous tension. Disease, improper foods and unsuitable working conditions reduce the effectiveness of the worker. Moreover, unless these various factors are known and accounted for, labor standardization, by tests and otherwise, decreases rapidly in validity. Accurate analysis of the individual's potential capacity and actual skill becomes impossible.

Formulating labor standards is but one phase of the whole process of knowing how well the factory and office, or company, is being run. Labor standards must be integrated with all the other operating standards of the business. We have shown how closely the processes of selection and placement articulate with other operating standards and to what extent they are dependent on the various physical standards. Furthermore, unless the control of all operations runs smoothly no standard can long retain its value.

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[7] Pond, Dr. Millicent, "Selective Placement of Metal Workers," *The Personnel Journal,* Vol. V, 1927, pp. 345, 405, 452.

An Industrial Esperanto[1]

By L. URWICK

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UNDER the title, "The Industrial Tower of Babel," which appeared in the August 1, 1928, number of the *Labour Magazine,* Mr. R. M. Fox reviewed the Congress of the International Association for the Study and Improvement of Human Relations and Conditions in Industry, which took place at Cambridge in July. As he rightly observed "the keynote of the Congress was to be found in the declaration that work is a social function, industry is a science." Apparently this point of departure met with his approval. On the other hand, he was critical of those who believed in scientific management. He did not seem to appreciate that Taylor was the first man to insist to the world that industry is a science, that the only hope of the dispassionate study of work as a social function lies with those who would apply the definition, the intellectual methods, and the ethical standards which inspire scientific workers.

Much early mythology still centers round the work of F. W. Taylor. The founder of scientific management, as is the case with nearly all great and original thinkers, was hugely misrepresented in the days when his work first attracted public attention. He was particularly distorted by a large number of unscrupulous people who advertised themselves as "efficiency engineers" in order to exploit the goodwill attaching to his ideas. Since they had no conception of the underlying principles on which those ideas were based, they were guilty of many crimes both against the employers who consulted them, and against the workers in those factories with which they were permitted to experiment.

It is, therefore, not surprising that the trade union world in the United States should have reacted sharply against what it described as "Taylorism." Over several successive years the annual congress of the American Federation of Labor passed the strongest possible resolutions on the subject, which contained such phrases as "the hideous and tyrannical so-called Taylor system." This chain of events was naturally well known to trade union leaders in England. A feeling grew up among the workers that scientific management was something hard and ruthless, and that their sole concern with it was to oppose it with might and main.

The fact is that the question of scientific management has been confused with the various matters at issue between labor and capital. With that great controversy it has, properly considered, nothing directly to do. As a trade union representative from Vienna pointed out at the Cambridge Conference: "Whatever may be the ultimate political organization of industry, there will always be human problems arising from the employment of persons." Unless we are prepared to scrap the whole of our modern machinery of production, in which case we should have to cut down our population by more than two-thirds, we must contemplate a state of society in which there are those whose function it is to plan and to direct, and those whose function it is to carry out these plans and directions.

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[1] First printed in *Labour Magazine,* October, 1928.

The same consideration applies to our political, educational, recreational, and other forms of social organization. As F. W. Taylor himself constantly insisted, scientific management is not a system. It does not consist of a particular series of methods and devices. It is an attitude of mind, a method of approach to all those problems which arise from the employment of persons, whoever happens to be in control, or whatever the purpose in view. It is as applicable to a government department, a church, a football club, or to the international administration of a trade union as it is to the conduct of a factory under the control of a limited liability company.

It differs from the older conceptions of management in this, that it approaches all such problems afresh, with the methods, the standards, and the intellectual technique of the scientist. It endeavors to secure that every decision is arrived at, not as the result of rule of thumb, guesswork, or personal emotion, but by a careful collection, balancing, measurement, and test of *all* the available facts bearing on the point at issue.

The methods of science are analysis, definition, measurement, and proof. The scientist forms tentative conclusions by means of experiment, and is constantly engaged in adjusting these conclusions in the light of fresh hypotheses or of fresh groups of facts. Where they stand this searching test they issue in the formation of principles and laws. As will presently be recognized, more particularly by the workers, it was F. W. Taylor who first insisted on this great principle, that the confusion of modern industrial administration can only be solved in the light of principles, evolved by the methods of thought which have inspired the triumphs of modern discovery in the material sciences.

Inevitably, Taylor's work was tentative and incomplete — as the work of Darwin in biology has been rounded out by later workers in the same field. Experimental psychologists of the English school have rightly called attention to the importance of individual rhythms and the necessity of modifying the conception of the "one best way" in the light of more recent discoveries. Taylor himself would have welcomed such discoveries. He even envisaged developments in experimental psychology which have taken place since his day. "There is one science," he writes, "to which insufficient attention has been given, the science of human motives."

Similarly in the United States, the technique which he applied specially to the problems of machine production, has been carried over into the field of industrial relations. The results in many factories in the increased comfort, welfare, and contentment of the workers have been noted by the Mackenzie Commission, and by many trade union observers.

Those who have made the closest study of his underlying philosophy are the most convinced that the faults of expression and the ignorant and piecemeal attempts to apply his methods which brought his work into temporary disrepute with the American trade unions in no way represented the fine social idealism and underlying vision of the man himself. It is true that in his later years he was critical of the trade unions. He was a human being. And in the confusion of immediate controversy they had covered with obloquy the work and the ideas to which he had given his life and his fortune.

This is being realized by ever increasing numbers of persons in all branches of the labor movement. For some years past, leaders of the American trade unions have taken note of two important facts. In the first place it is just in those factories where Taylor's principles are most thoroughly understood, that they find the strongest support for the doctrine of high wages. Secondly, it is there, too, that they find the greatest willingness to co-operate in working out experiments in industrial relations.

The past and present presidents of the American Federation of Labor have declared roundly in favor of scientific methods of production and the elimination of waste. At a recent conference a representative of the printers described how his union had established its own consultants in scientific management. When an employer said that he could not pay the union rates, they sent a representative along to advise him on the better management of his plant.

The same is true of England. It is not the employers who are indifferent to labor and its developing status who are most interested in scientific management. It is the Renolds and the Rowntrees—the men who are most willing to accord full recognition to trade unionism and to co-operate with its leaders in working out in practice those measures by which the workers may collaborate critically and creatively, and take a growing part in the running of industry.

Many of the leaders of the Labour Party appreciate this. Mr. Bevin's signature appears under the report of the Mackenzie Commission. Mr. Pugh recently said at a conference at the Guildhall: "Rationalization involves scientific management, a much misunderstood term. This does not mean the regimentation of labor, a sort of goose-step to the time of the machine; it means the science of good management, good government in industry, applied to the workshop, winning the co-operation of labor for the elimination of waste in human effort, material, and organization, and in getting the best results in productive enterprises and services. Combined with this is the acceptance of the principle that in the science of good management, cutting down wages and extending hours of labor is the last and not the first resource."

Turning to the left wing, it may be noticed that one of the first actions of the U.S.S.R. was to establish in Moscow an institution for the study of F. W. Taylor's work, and of the developments which have flowed from it. Is any further evidence needed that the science of management is not integral with the present political organization of industry, an employers' dodge to be dismissed with a shrug, but is something essential to any form of effort in which men must co-operate?

But the prejudice remains. Many workers seem to be totally unaware that the chief motive which drove Taylor to try to evolve a new approach to questions of industrial management was the disgust of a sympathetic and sensitive man at the bullying methods which were the common currency of foremanship in the American machine shop of the '80's. To say, as has been said, that Taylor desired "to remove all initiative, all thought, all criticism from the workshop," and to "degrade the worker into a productive machine" is preposterously wide of the mark. One wonders how many of his critics have studied the standard biography of the great reformer.[2]

Now, this prejudice is important. Because it blinds some of the ablest minds in the labor movement to the strongest line of attack against many of the inequalities and injustices under which the workers suffer, an attack on the obsolete methods of management which give rise to them. Moreover, it prevents a proper understanding between the worker groups and those groups of managers and technicians who, economically, should be in sympathy with them. Collaboration is a social fact. It will remain a social fact whoever owns the industrial capital of the country, or on whatever system our industry is organized. Today, co-operative societies, municipal undertakings, and government departments have their problems of management, no less than capitalistic undertakings. They can only be solved with the consent and willing co-operation of all concerned.

But men cannot collaborate, they cannot even negotiate or discuss a question intelligently together unless the words they use have the same meaning for all of them. An effort to introduce a common language into the industrial babel is probably the most important problem which now confronts the world. The only progress which has ever been achieved in this direction has been in the established sciences. In mathematics, physics, and chemistry, men of different races and different social status can speak together on their problems of common interest. Because they have used the intellectual technique of the investigator—analysis, definition, measurement, and proof — they have established a currency for the rapid and easy exchange of ideas in the search for truth. There is no other path by which we can march to the solution of our industrial and social difficulties.

When, therefore, representatives of the workers say that "they do not believe in scientific management," when they misrepresent the essential work which F. W. Taylor performed—the application to industrial problems of the scientific intellectual technique—what they are really saying is this:

"We do not believe in definition. We do not want analysis. We abhor measurement. We are indifferent to proof." They are shutting the door on the only real hope, the progressive discovery of truth. They are denying at the start any possibility of collaboration, because they will not use the intellectual methods by which alone the verbal instruments of collaboration can be forged. They leave the manager and technician feeling like a Darwinian biologist trying to talk to a fundamentalist from Dayton.

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[2] Copley, Frank Barclay, *"Frederick W. Taylor, the Father of Scientific Management,"* New York, Harper & Brothers, 1923.

News of the Sections

University of North Carolina

A New Student Section

After spending two weeks, May 6 to 17, in Ames, Iowa, where he delivered a course of fifteen lectures on scientific management at the School of Commerce, University of Iowa, Dr. Person went to Chapel Hill, North Carolina, on May 28, and addressed several groups of students and faculty in the Department of Economics and Commerce at the University of North Carolina.

At the invitation of the University he lectured to a class in Personnel Management on the subject of scientific management's attitude toward the problems of industrial relations, and to a class in Business Organization on the demands of modern management on young men entering industry; in the afternoon he met a group of faculty members and graduate students and led a general discussion on the importance of management in industry. In the evening he gave an address on the origin and nature of scientific management and its influence on American industry. The address was delivered before the new University Student Branch of the Taylor Society which was organized under Professor G. T. Schwenning's guidance in March.

Central New York

At the meeting in Syracuse on April 26 Henry S. Dennison, President of the Dennison Manufacturing Company and former President of the Taylor Society, addressed the group on "Major Problems Which Executives Will Have to Face in the Next Five Years." Jason Westerfield of the New York Stock Exchange spoke on May 24 on "What the Stock Exchange Is and Does."

New York Metropolitan

The meeting on May 16 at the Fraternity Clubs was given over to a discussion of "Cost Control, with Fluctuating Production, Through Predetermined Cost Standards." Floyd F. Hovey of the Department of Industrial Economy of the Eastman Kodak Company had prepared a most stimulating paper which was discussed by John H. Williams, Consulting Engineer, and W. S. Powers of Miller-Franklin and Company, Inc.

A slate of officers for the coming years was presented by the nominating committee and accepted by the membership. Mr. R. G. Wagenet was re-elected as Chairman and Miss Chalice M. Kelly of the Union Carbon and Carbide Company was elected Secretary. The Executive Committee consists of the officers and John M. Carmody, Editor *Factory and Industrial Management;* Homer C. Holland, Irving Trust; Mrs. Rita Hillborn Hopf, H. A. Hopf and Company; Howard M. Hubbard, Royal Baking Powder Company, and John E. O'Gara, R. H. Macy & Co., Inc.

Reviews

New Way to Net Profits. By Fred W. Shibley, Harper & Brothers, New York, 1928, pages xxi, 213.

First analyze your situation, determine its elements; then put together the necessary elements so as to accomplish the result most speedily and most economically. Analysis—synthesis. Thus were we taught who as apprentices began twenty to thirty years ago to follow the lead of the founders of the philosophy of scientific management. "Who knows? Nobody knows! Let's find out!" was said again and again as various situations were encountered, and accurate knowledge was demanded. At that time we were thinking of shop management, of motion study, of standardizing operations and jobs, of developing and perfecting that technique of factory practice which has made possible in later years production planning and the nice balancing of output of one department or process against another.

Some of the apprentices wondered why the same kind of thinking was not being applied to the major policies of business. They hated to see judgments made and policies decided on half facts and on hunch. But industry prospered. Prices were rising. Frequently anyone who owned an inventory made money before he sold it. The depression of the panic of 1907 and that at the start of the World War in 1914 were only temporary setbacks. Then followed the enormous inflation of the war and post-war periods, both of commodity prices and of producing capacity.

And then followed 1920, and then 1921. And the executives, many of whom were the apprentices of the earlier period, began to think, and to ask, "Why?" The answer to this "Why?" on the part of executives and of bankers is what Mr. Shibley so clearly brings out. His book is a very clear, simple statement of the application of the old principle of analysis and synthesis to the major problems and policies of a business. It is not technical. There are no charts or statistics. But it gets to the point clearly, forcefully, quickly.

The new way to net profits is exactly the same in principle as the new way to reduced shop costs as pointed out by Taylor: the statement of a man of long experience with many types of business concerning methods of approach and results obtainable. A few decades ago most consideration of business started with raw materials and production. The first thought was—What shall we make? Anything of reasonable value which could be made could be sold. It is significant that Mr. Shibley, after the introductory chapter "Why the new way was found necessary," takes as the subject of his second chapter, "Market study," and its opening words, "The capacity of the consumer to purchase is the essential consideration in the forecasting of sales," indicates the importance he places on the market itself. The importance of having market study done by the organization itself is also stressed, for it does little good for the executives of any organization to hire someone to do their thinking for them. This is really what many attempts at market study have amounted to. No sales plan can start on a sound basis except where founded on market study. Without it production plans and financial plans are also derived from uncertain origin. In all planning of corporate activities it is necessary first to determine volume, for this in turn will determine income and expense. Hence it is vitally important to base the estimated volume on a thorough knowledge of customers, their buying power, their needs, their interests and demands. A potential need is not always easily converted into a demand which will make sales. "Simplified and boiled down to a common-sense content, market study is an absolutely necessary phase of scientific administration. In fact, there can be no scientific administration without it. It is the primary principle of the system, the foundation on which it rests."

Even merchandising, "the most artistic of the elements" of business, is passing out of the realm of the art and into that of the science. Careful market study must of course precede the formulation of a merchandising policy. Price exercises a dominant influence in most sales, and the art in merchandising lies in so presenting a product for sale that price becomes secondary to quality, design and style.

Eye value, as it is sometimes called, has a strong appeal in the sale of any article. Hence style and design assume great importance, and the real merchant is he who adds these qualities to his goods in process, rather than he who simply acts as a distributor. Style is today a factor which has entered nearly every industry, and profitable price goes only with the latest style. Frequent style changes are a menace to the unprogressive manufacturer but a blessing to the wide-awake one.

The quality needed to fit the market is the basic principle for all products, not as a result of rigid inspection causing a high percentage of rejections, but from the careful planning and processing of goods at every step.

The selection of a line of products can be guided by research and analysis. Price must depend on profit producing power and upon the rapidity of turnover. A merchandise policy based on rapid turnover cannot go far wrong.

The chapter on distribution traces the history of trade in this country and indicates clearly how and why in the constantly expanding sellers' market, the sellers (manufacturers) let someone else do their real job for so long that they completely lost control of their outlets and markets.

"The sales forecast evolves naturally from this study of markets and of scientific methods of merchandising and distribution." No proper budget of expense can be set up unless it is also known what the income is to be, and income results from sales.

The sales forecast is converted into tangible results by sales on the one hand and by production on the other. To obtain the balanced operations necessary for economy and minimum inventory, productions must be planned far in advance. The instance is cited of the complete mechanization of a plant for making automobile frames. In this case the production planning was incorporated into the machine so as to make the entire series of operations automatic.

Budgetary control is the instrument to tie together sales forecast, production plans, and expense schedules. Every expense must be productive and must give some direct or indirect return to the stockholders. The budget shows not alone what conditions are, but what the possibilities are. Many a business is in going condition today because of control brought about by a budget and the possibilities which it showed to the company's bankers.

The true purpose of management is the co-ordination and control of all the activities of a business, for the production of profits to its owners. The purpose of sales forecast, production planning, and all the rest is the production of profits. Profits can be planned just as production can be planned.

In the chapters on Research and Analysis are many instances showing the results of the application of thought and analysis to the problems of business. Some people must do the operating of a business, but to others must be delegated the solution of many of its more abstruse problems, which can only be solved by patient and painstaking study.

So the "New Way to Net Profits" is an application of old principles to the profit making end of business, with a greatly developed technique. First, state your problem, then analyze its elements. The sales forecast resulting from market analysis, the production schedule, the expense budget—all are steps, and each one must be broken down into its elements and then built into a structure whereby it can be controlled, so that the goal of net profits can be attained.

W. O. JELLEME[1]

Types of Business Enterprise. By Maurice Condit Cross, Prentice-Hall, Inc., New York, 1928, pages x, 338.

This is the third book of this type to have made its appearance. The first was offered to the public under the title, "Business Organization and Combination" by Lewis H. Haney, while the second—"Business Ownership Organization," by A. H. Stockder—was published in 1922. All three of these works are similar in content, a result that may be attributed largely to the avowed intention of the authors to provide a text-book for use in collegiate instruction. Each deals with the technical features and uses made of the legal devices that are employed in the ownership and conduct of business enterprise. Another similarity is found in that each of the three goes into a discussion of the forms and purposes of combination, together with a general critique of "big business."

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[1] Manager of Production and Inventory Control, Pacific Mills, Lawrence & Co., New York, N. Y.

Your reviewer obviously cannot criticise Mr. Cross' work without indirectly reflecting upon his own. In fact, he would feel more free to point out the weakness of his own work than of one that parallels it so closely. On the whole, however, Mr. Cross has selected his material carefully, laid it out and arranged it very satisfactorily, and presents it in well chosen and readable language.

A. H. STOCKDER[2]

The Road to Plenty. By William T. Foster and Waddill Catchings, Houghton Mifflin Company, Boston, 1928, pages vi, 231.

Since Henry George wrote "Progress and Poverty" few books on economics have been as readable and convincing as "The Road to Plenty." It has style, human incident, drama, sentiment and enthusiasm.

Putting live human beings into the discussion of unemployment and business depressions makes these themes vibrate with interest. The discussers are fellow passengers in a Pullman smoker, and the kind we know so well. The unusual begins to happen only when the argument reaches a conclusion.

The conclusion is a plan of action to stabilize production and employment. The prosperity reserve which Mr. Hoover advocated by sending a message to the Congress of Governors is one part. A construction reserve of the federal, state and city governments is to be released when indexes of employment and production fall to a certain point. This demand for materials and for workers is the first line of defense. The new credit created by the sale of municipal bonds and by other methods will create a rising purchasing power when it would otherwise fall. The wages of the construction workers and makers and transporters of materials will create a demand for shoes, shirts, candy, movies, etc., and give new employment in these secondary industries. The wages of the workers in the secondary industries will be expended upon goods requiring the employment of workers in another group of industries, and so on. The curve of depression will be prevented from falling to the low levels of the past. This will be made possible in part by taking some public construction off the upper, rising curve of boom times, thus straightening it out without necessarily altering the total volume of public construction in a five year period.

The authors are primarily interested in proving why the regular and necessary operations of business produce at times greater producing than consuming power. This is because all the profits are never paid out to consumers, but are partly invested in plants, etc. When the supply of goods is greater than the consuming power, new credits alone can enable the supply goods to be taken away by the consumer. Thus credits must be spent upon something other than machinery to produce more consumers' goods, which would only aggravate the situation. Public works, roads, public buildings, sewers and city planning are not consumers' goods and therefore good tools to create the needed purchasing power. A Federal Board is suggested as fiscal overseer to insure stabilization.

The authors are mutually supplementary. Mr. Foster is primarily an economist and educator. Mr. Catchings is best known as an organizer of sick corporations, an active director in healthy ones and a partner in an important banking house.

"The Road to Plenty" is a significant addition to the literature related to scientific management in its widest sense.

OTTO T. MALLERY[3]

Factory Organization. By Clarence H. Northcott, Oliver Sheldon, J. W. Wardropper, and L. Urwick, Sir Isaac Pitman & Sons, Ltd., New York, 1928, pages xi, 252.

This is the most interesting book on factory management which has as yet come from English authors, covering as it does a number of phases of factory operation and organization. Principles rather than methods of administration are covered, although from time to time the several authors dip into rather detailed subjects, as for instance, in the Industrial Relations chapter, "Lunch Breaks," "Overtime," and "Short Time." It is doubtful whether in the rapidly growing organization of the United States the following would be agreed to. "The organization which is modeled to suit the capacities and peculiarities of particular individuals may succeed for a time. It is, however, like the seed which fell on thorny ground; it can only flourish whilst the temporary conditions, for which it was designed, continue to exist. With every change in personnel, the organization must be changed, and the results can only be confusion leading to unsatisfactory working. However specious may be the appearance of an organization designed to suit individuals at any particular time, its foundation cannot but be shifting sand."

On the other hand, leadership which this book will give in many directions is well illustrated by the following paragraph from the section on Marketing and Advertising. "It seems probable that as the importance of marketing problems becomes, once more, keenly appreciated and studied by the English manufacturer, the tendency to place a large proportion of the executive work in the hands of the advertising agent will be reversed. Manufacturers will establish their own staff of artists, window-dressers, and similar craftsmen for the executive side of their advertising work. They will leave to the advertising agent his original function of placing copy with the Press."

Unquestionably this book will be of inestimable value in furthering the cause of better management in Great Britain and English possessions throughout the world.

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